316 (b) DEMONSTRATION

GORGAS
STEAM ELECTRIC
GENERATING PLANT

ALABAMA POWER COMPANY

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CHAPTER I

SUMMARY, CONCLUSIONS

SUMMARY

This document along with accompanying appendices containing summerized data comprise Alabama Power Company's 316(b) demonstration for the Gorgas Steam Electric Generating Plant. It summarizes results from engineering and biological studies to evaluate the effects of the Gorgas Plant intake system upon the aquatic environment of the Mulberry Fork of the Warrior River. This report has been prepared by engineers and biologists of Alabama Power Company. Gorgas Plant personnel have been of valuable assistance in conducting the impingement sampling.

CONCLUSIONS

1. The use of a deeply submerged skimming weir, 30 to 40 feet below the surface, reduces the probability of entrainment of surface oriented aquatic organisms.
2. Seasonal variations in intake velocities due to scheduling of condenser pump operation do not produce a noticable effect on the rates of impingement.
3. The impingement and entrainment of aquatic organisms due to normal Plant operation do not have a significant effect on the aquatic communities of the Mulberry Fork.
4. Larval fish populations in the vicinity of the Plant are not significantly affected by entrainment.

CHAPTER II

PLANT CHARACTERISTICS

LOCATION AND PHYSICAL DESCRIPTION

The Gorgas Steam Electric Generating Plant currently has six (6) independent generating units that have a combined manufacturer's rated capacity of 1,281,250 KW. Individual unit capacities are shown in Table 1. The Gorgas Plant is located on the Mulberry Fork of the Warrior River System near river mile 399. This location of the Mulberry Fork is in the headwaters of the reservoir formed by Bankhead Dam (river mile 365.5) and is normally held at an elevation of 255 feet MSL.

TABLE 1. GORGAS STEAM PLANT UNIT CAPACITY

Unit No.	In Service Date	Manufacturers Rated Capacity (KW)
5	1944	60,000
6	1951	100,000
7	1952	100,000
8	1956	156,250
9	1958	165,000
10	1972	700,000

Figure 1 shows the location of the Gorgas Plant relative to Bankhead Dam and Hydroelectric Generating Plant and upstream Lewis Smith Dam and Hydroelectric Generating Plant. The Lewis Smith Dam and Hydroelectric Generating Plant are located on the Sipsey Fork upstream of Gorgas at river mile 443.2.

The Mulberry Fork and the Locust Fork join at river mile 385.4 to form the Black Warrior River. From this confluence to the John Hollis Bankhead Lock and Dam, the River is a relatively wide, deep reservoir. However, upstream from this confluence, the Mulberry Fork is characteristically a relatively

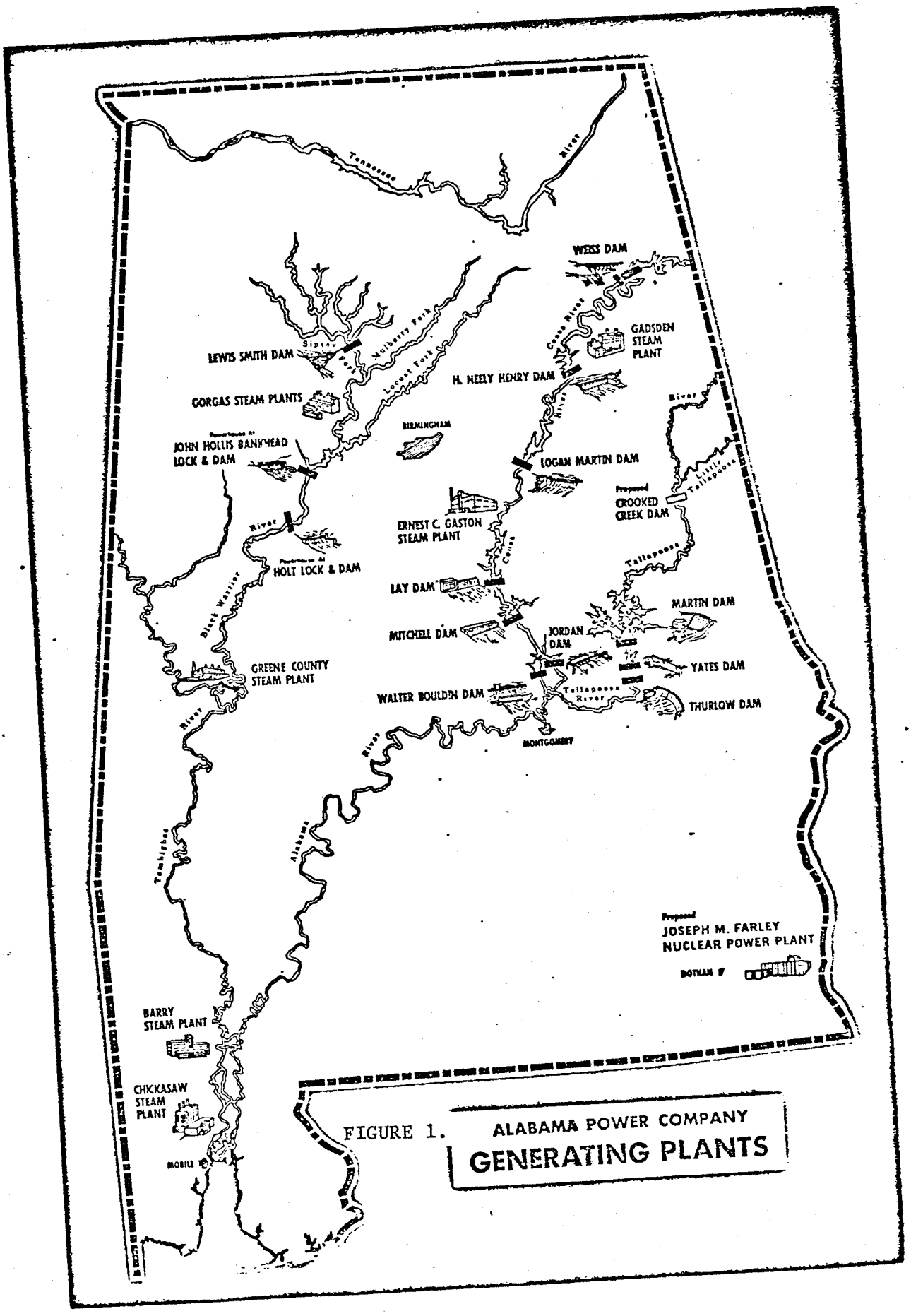


FIGURE 1. ALABAMA POWER COMPANY
GENERATING PLANTS

long, narrow, and deep body of water. The studies covered in this report are limited to the stretch of the Mulberry Fork near the Gorgas Plant since this is the area affected by the Plant operation.

A schematic of the Plant Site is shown in Figure 2. The intake for the condenser cooling water canal is located at river mile 399.6, with the discharge located about one mile downstream. The Plant discharges into an embayment of Mulberry Fork, known as Bakers Creek.

The winter and summer cooling water design flows and temperature rises for the Gorgas Steam Electric Generating Plant are summarized in Table 2.

TABLE 2. CONDENSER CHARACTERISTICS

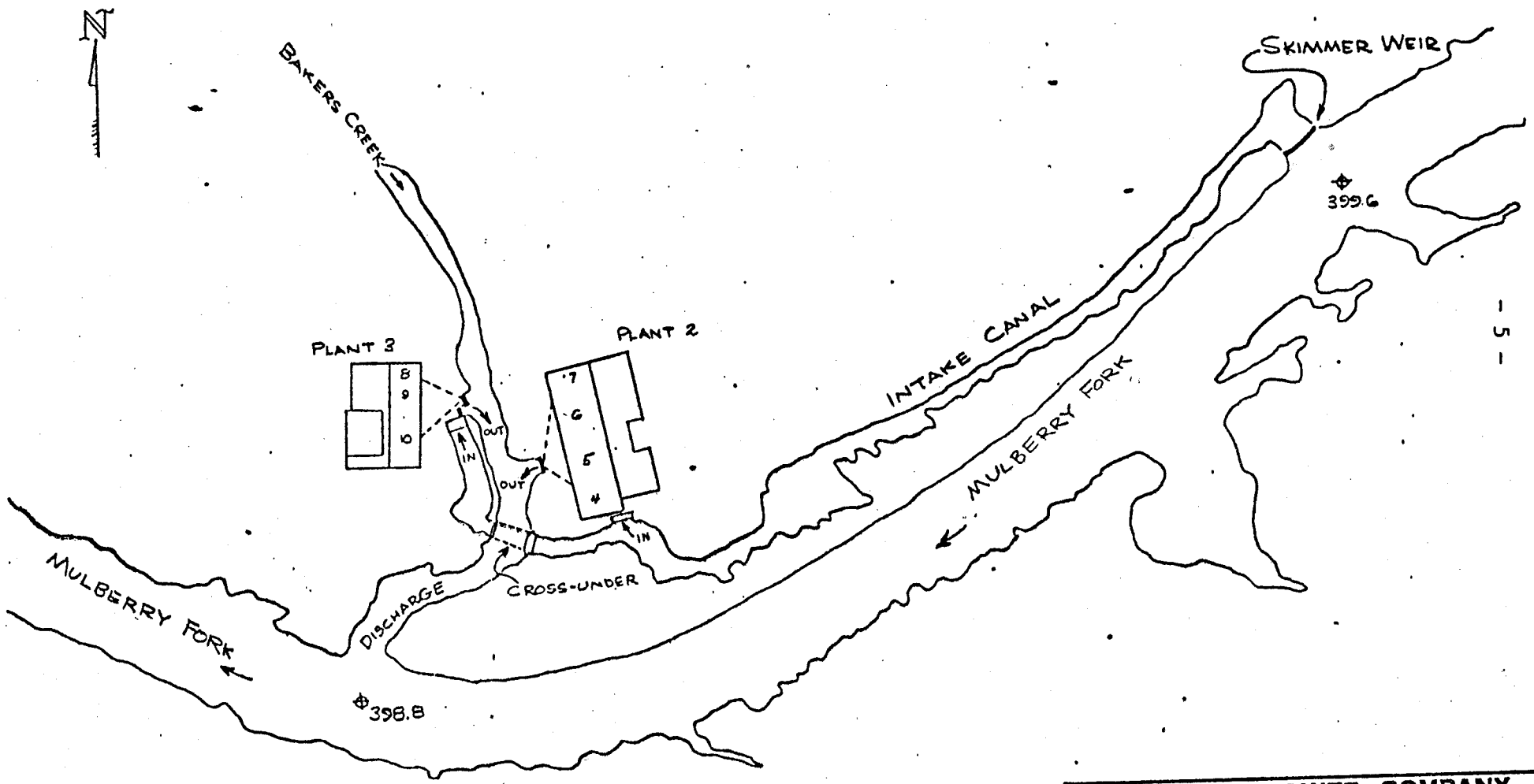
Unit No.	Condenser Cooling Water Flow, GPM		Calculated Temperature Rise (Δ T), ^{o}F *	
	Winter	Summer	Winter	Summer
5	42,000	59,000	17.2	12.2
6	60,000	89,000	18.1	12.2
7	60,000	89,000	18.1	12.2
8	65,000	100,000	22.2	14.5
9	73,000	110,000	20.8	13.8
10	292,000	292,000	21.0	21.0

*Calculated Temperature rise at rated capacity, with 80^{o}F cooling water temperature.

Intake Description

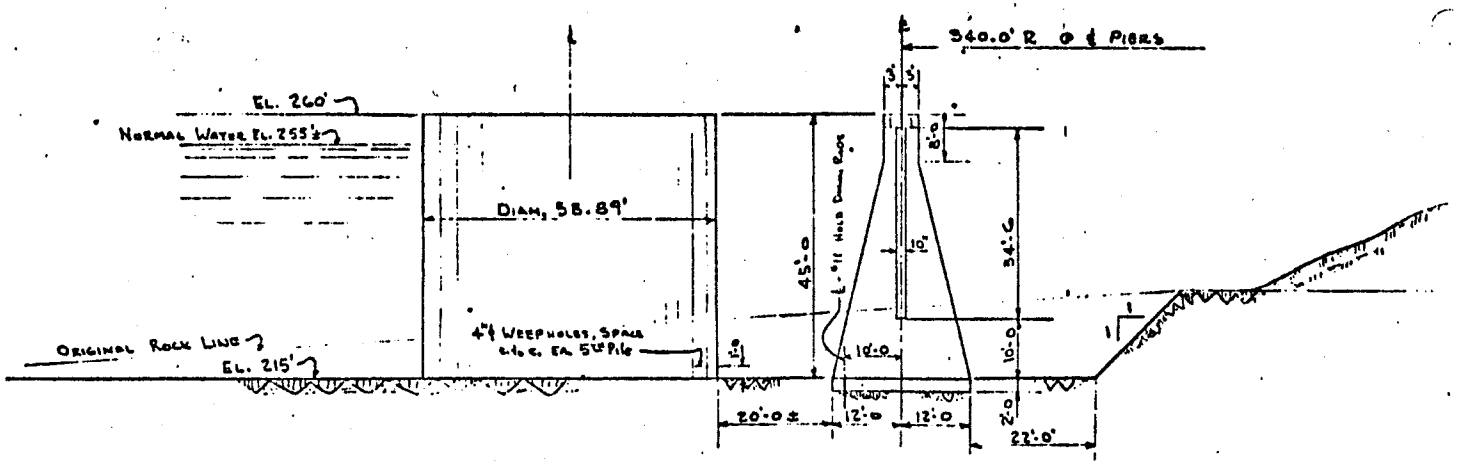
The cooling water for the Gorgas Steam Electric Generating Plant is withdrawn from the Mulberry Fork through an inverted skimming weir. The intake opening extends from a depth of 30 to 40 feet below the water surface (see Figure 3; for additional intake details, see Appendix I-1). The calculated average water velocity through the weir is 1.65 fps. A cross section of the River in front of the skimmer is shown in Figure 4. This system was designed to afford maximum use of the cold water

FIGURE 2. SCHEMATIC OF PLANT SITE



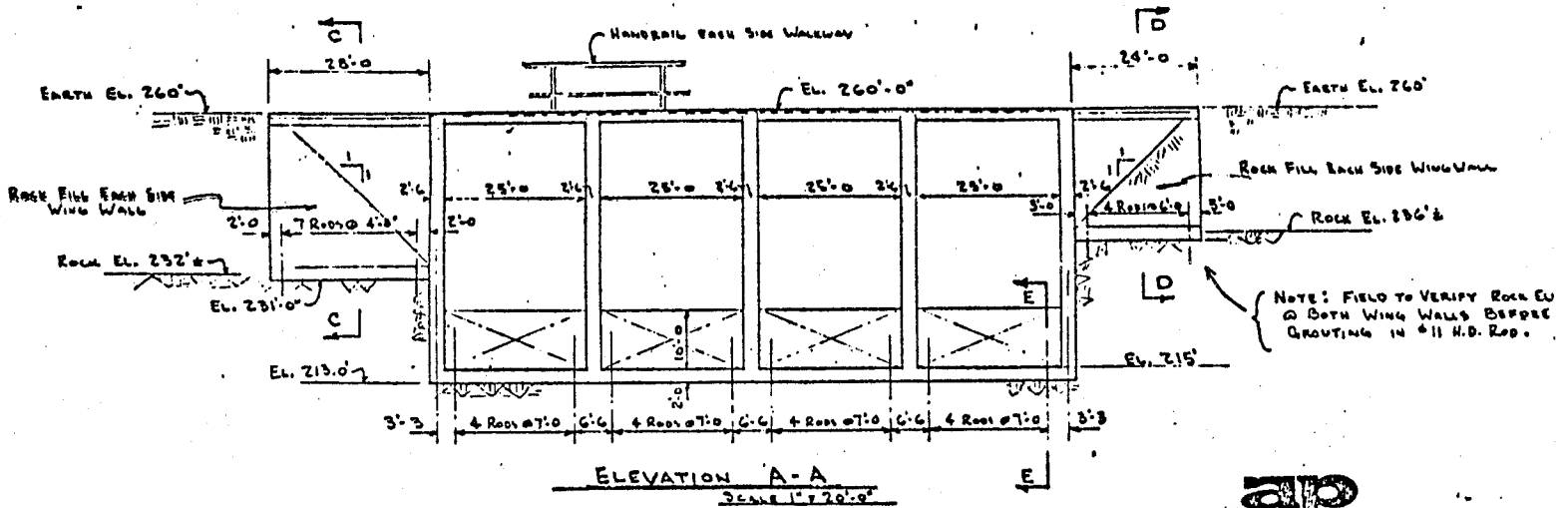
- 5 -

ALABAMA POWER COMPANY	
SUBJECT GORGAS STEAM PLANT	
DETAIL IDENTIFICATION of CIRCULATING WATER SYSTEM	
DRAWN ____ TRACED ____ DATE 8-7-75	SCALE ____
CHECKED ____ DATE ____	SHEET 1 OF 1 SHEETS
APPROVED ____ DATE ____	SUPERSEDES ____
	B-



SECTION B-B THRU ϕ INTAKE

Scale 1" = 20'



ELEVATION A-A

Scale 1" = 20'-0"

FIGURE 3. INTAKE SKIMMING WEIR

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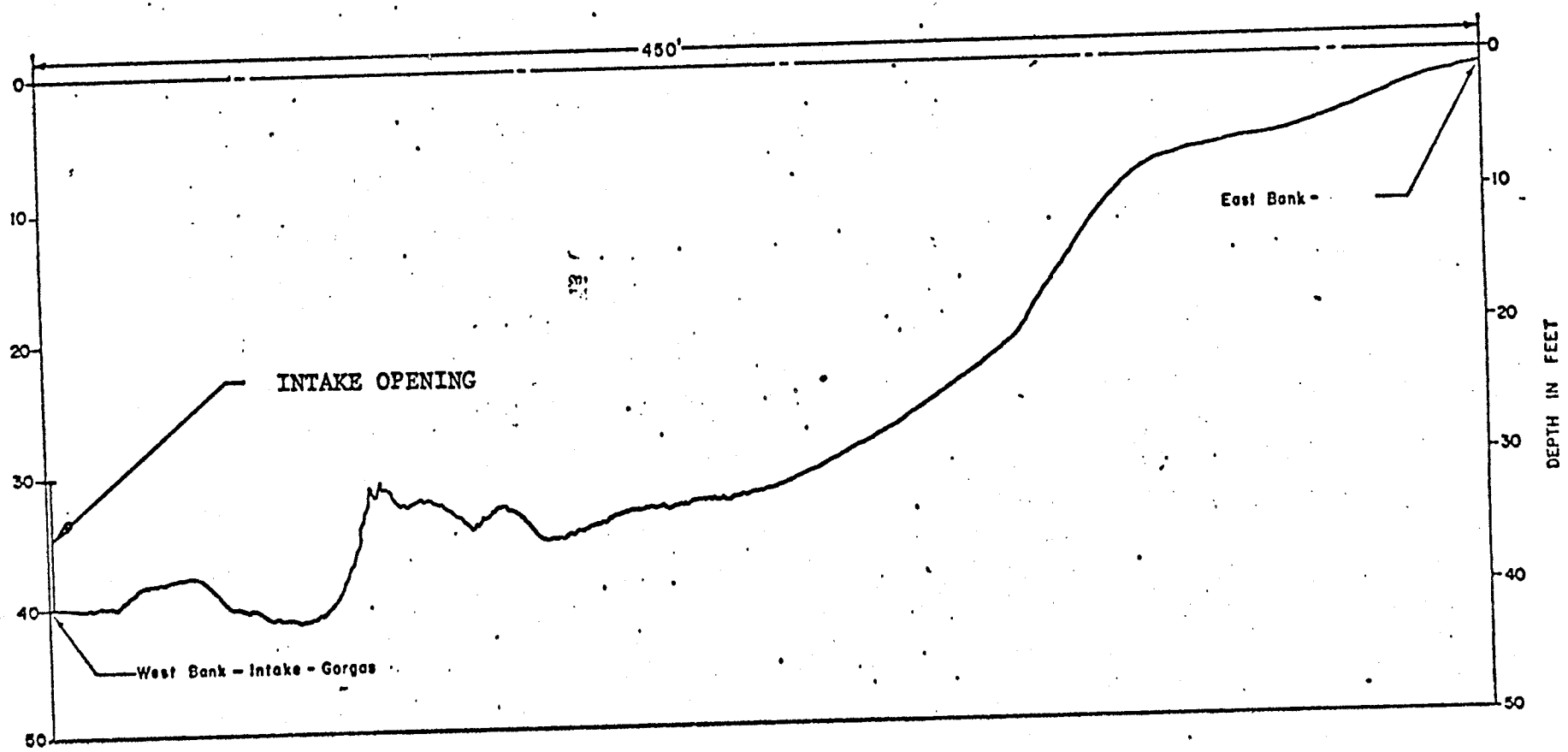
FIGURE. 4. CROSS SECTION OF MULBERRY FORK IN FRONT OF THE INTAKE SKIMMING WEIR



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release from Smith Dam.

After the cooling water is withdrawn from the River, it flows through the .8 mile long intake canal to the Plant unit intakes. A plan view of the intake structure for Units 5, 6, and 7 is shown in Appendix I-2. The intake structure for Units 8, 9, and 10 is shown in Appendix I-3. A typical detail of the intake screens is illustrated in Appendix I-4.

The average velocities through the Plant intake structures are shown below:

Unit No.	Calculated Average Water Velocity Thru The Trash Racks (fps)	Calculated Average Water Velocity Thru Intake Screens (fps)
5, 6, 7	.88	1.00
.8, 9, 10	1.03	1.84

The intake canal delivers water to two intake structures; one serving Units 5 through 7, and the other serving Units 8 through 10.

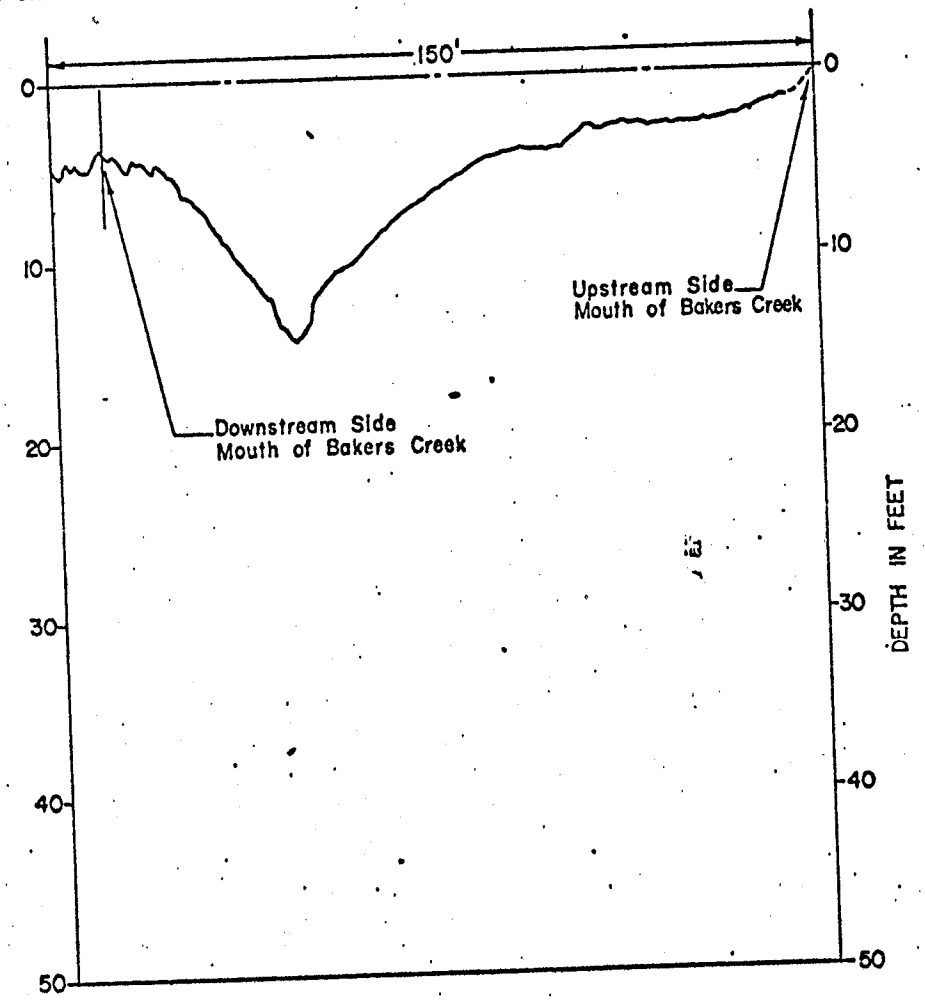
Vertical traveling screens, made of woven wire mesh with 3/8 inch square opening, are positioned behind trash racks at both intakes. Materials picked up on traveling screens at the intake serving Units 5, 6, and 7, are ejected by high pressure water jets into a common sluiceway, returning these materials to the branch of the intake canal serving Units 8, 9, and 10. The screen wash material from Units 5, 6, and 7 is carried down the intake canal and eventually removed by the traveling screens at the intake serving Units 8, 9, and 10. Materials removed by the traveling screens at the intake serving Units 8, 9, and 10 are ejected by high pressure water jets into a common sluiceway, which empties into Bakers Creek (See Figure 2).

At the Gorgas Steam Electric Generating Plant, Plant personnel inspect the rotating screens every three to four hours and operate the screens as required to provide cooling water flow to the condensers.

There are no chemicals used in the intake system.

Figure 2 shows the general arrangement of the Plant discharges, with respect to the Mulberry Fork of the Warrior River. Figure 5 shows a cross section of the mouth of the discharge canal (Bakers Creek). The calculated discharge velocity at the mouth of the canal during summer operation, with two pumps on all six units, is 1.7 ft/sec. During winter operation, with one pump on Units 5 through 9, the calculated discharge velocity is 1.4 ft/sec. The condenser discharge flow contains no biocides.

FIGURE 5. CROSS SECTION OF BAKERS CREEK AT CONFLUENCE WITH MULBERRY FORK



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CHAPTER III

BIOLOGICAL MONITORING

IMPINGEMENT

Monitoring Procedure

Impingement monitoring at Gorgas Generating Plant was carried out at the intake serving Units 8, 9, and 10. Data collected at the intake serving Units 8, 9, and 10 is a measure of total impingement losses at both intakes, due to the return of screen wash materials from Units 5, 6, and 7 to the intake canal.

Fish impinged on intake screens were collected for one continuous 24-hour period weekly by placing a wire basket with a 3/8 inch mesh size in the screen wash sluiceway serving Units 8, 9, and 10. All intake screens for Units 8, 9, and 10 were rotated and cleaned before the start of each sample period. Intake screens were generally rotated every three to four hours for approximately 15 minutes; however, during periods of high debris collection,screens were rotated continuously. All fish collected during each sample period were identified and counted. The total length of each fish collected was expressed as greater than or less than six inches.

Results and Discussion

Impingement monitoring at Gorgas Generating Plant began on January 26, 1974 and continued through July 31, 1975. A total of 68 days were sampled out of a possible 76, based on a seven day sample frequency. Samples were not obtained during eight sample periods due to failure of sample equipment. Due to a higher incidence of equipment failure during the initial part of this period, calculations of impingement rates at Gorgas were based upon samples taken from August 1974 through July 1975.

A total of eleven general catagories of fish were impinged on the intake screens at Gorgas Steam Plant (Tables 3 and 4). The most numerous of the fishes collected were the shad at 27,049 comprising 99.0% of the total (Table 5). Shad were collected every month during the entire monitoring period. Daily impingement rates for shad varried considerably from week to week; however, average daily impingement rates for each month were more or less evenly distributed. August and December of 1974 had the highest average daily impingement rate for shad (Table 3).

Sunfish or bream were the most numerous of the non-shad fishes collected. A total of 133 sunfish were collected during the monitoring period, which represented 0.5% of the total and 51% of the non-shad fishes. Catfish, crappie, suckers, drum, white bass, carp, largemouth bass, and buffalo made up the remainder of the non-shad fishes collected. Impingement of non-shad species was not evenly distributed throughout the study period. In 1974, 89% of the non-shad fishes were collected during the months of April, May, June, July, and August (Table 3). All fishes collected during the study and their percent occurrence is presented in Table 5.

The majority of fish collected from the intake screens at Gorgas Steam Plant were less than 6 inches in total length (Figures 6, 7, 8, and 9). Fishes less than 6 inches in length accounted for 86% of the total fish collected.

Summary and Conclusions

A total of 27,313 fish were collected during 50 24-hour sample periods from August 1974 to July 1975. The annual impingement rate at Gorgas Steam Plant, based on data collected from August 1974 to July 1975, was estimated to be 202,296 fish. Shad accounted for 99.1% of the fishes

TABLE 3

MONTHLY SAMPLE MEANS AND CORRESPONDING PERCENTAGES FOR FISHES IMPINGED ON INTAKE SCREENS DURING TWENTY-FOUR HOUR SAMPLE PERIODS AT GORGAS STEAM PLANT DURING 1974

COMMON NAME	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Largemouth Bass				1.50 / 0.25							.25 / .03	
White or Striped Bass								2.50 / 0.20				
Sunfish			6.50 / 1.01	14.0 / 2.37	6.00 / 4.61	9.25 / 1.57	5.67 / 1.34	12.35 / 1.01				2.50 / .11
Catfish			1.50 / 0.23	1.50 / 0.25	3.60 / 2.76	8.75 / 1.48	1.67 / 0.39	2.00 / 0.16				
Suckers			1.50 / 0.23	11.50 / 1.94	2.80 / 2.15	7.75 / 1.31	1.00 / 0.23	0.05 / 0.04				
Drum				2.50 / 0.42	0.60 / 0.46	1.50 / 0.25	1.67 / 0.39	0.50 / 0.04				.50 / .02
Carp				1.00 / 0.16	0.60 / 0.46							.75 / .03
Shad	25 / 100	10 / 100	629.00 / 98.51	558.33 / 94.57	114,60 / 88.15	559.00 / 95.18	410.33 / 97.23	1185.75 / 98.44	38.25 / 100	39.67 / 100	771.25 / 99.96	2175.25 / 99.83
Crappie					1.80 / 1.38	1.00 / 0.17	1.33 / 0.31	1.00 / 0.08				.25 / .01
Eel							0.33 / 0.07					

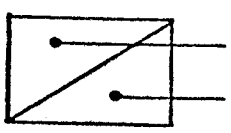
Average number impinged during 24 hour sample period

Percent occurrence

Table 4

Monthly Sample Means and Corresponding Percentages for Fishes Impinged on Intake Screens During Twenty-four Hour Sample Periods at Gorgas Steam Plant January - July, 1975

Common Name	Jan.	Feb.	Mar.	April	May	June	July
Largemouth bass						0.50 / 0.52	
Sunfish	0.40 / 0.14	1.00 / 0.30	0.25 / 0.11	0.75 / 0.55	3.80 / 4.11	4.25 / 4.40	5.40 / 1.07
Catfish	0.60 / 0.20			1.50 / 1.10	2.80 / 3.03	1.75 / 1.81	1.80 / 0.36
Suckers	0.02 / 0.07			0.50 / 0.37	1.60 / 1.73	0.75 / 0.78	0.40 / 0.08
Drumm	0.80 / 0.27				0.20 / 0.22	0.50 / 0.52	0.20 / 0.04
Carp					1.20 / 1.30		
Shad	292.40 / 99.32	330.80 / 99.46	222.75 / 99.66	133.75 / 98.00	80.40 / 87.01	86.25 / 89.15	497.00 / 98.42
Crappie		0.80 / 0.24	0.25 / 0.11		2.20 / 2.38	2.75 / 2.84	
Buffalo					0.20 / 0.22		
Gar			0.25 / 0.11				



Average number impinged during 24 hour sample period

Percent occurrence

TABLE 5 ESTIMATED ANNUAL NUMBERS AND DAILY AVERAGE OF FISH IMPINGED ON COOLING WATER INTAKE SCREENS AT GORGAS GENERATING PLANT AUG.'74 - JULY '75

Common Name	No. Collected	Estimated Annual Count	Average Daily Count	Percent Occurence
Shad	27,049	200,437	549.14	99.1 *
Sunfish	133	942	2.58	50.7 **
Catfish	47	322	0.88	17.3
Crappie	31	222	0.61	11.9
Suckers	18	122	0.33	6.6
Drum	12	84	0.23	4.5
White Bass	10	78	0.21	4.2
Carp	9	60	0.16	3.2
Largemouth bass	3	23	0.06	1.2
Buffalo	1	6	0.02	0.3
Total	27,313	202,296	554.22	-
Total Non Shad	264	1,859	5.08	

* Percent occurrence of all fish impinged.

** Percent occurrence of fish impinged exclusive of shad.

FIGURE 6

Fish Less Than 6 Inches Impinged on Cooling Water Intake Screens at Gorgas Steam-Electric Generating Plant during 1974.

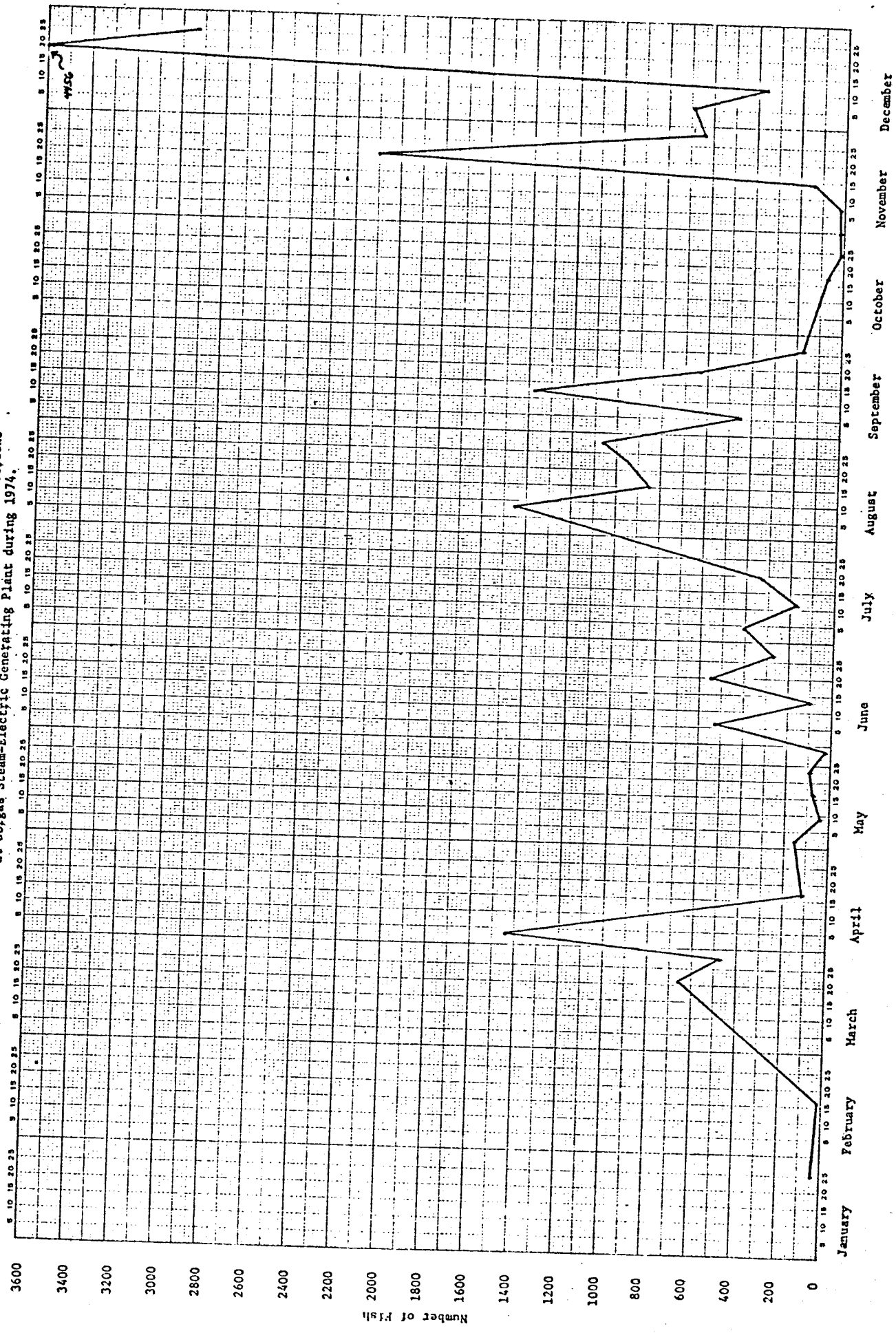


FIGURE 7

Fish Greater Than 6 Inches Impinged on Cooling Water Intake Screens at Gorgas Steam-Electric Generating Plant during 1974.

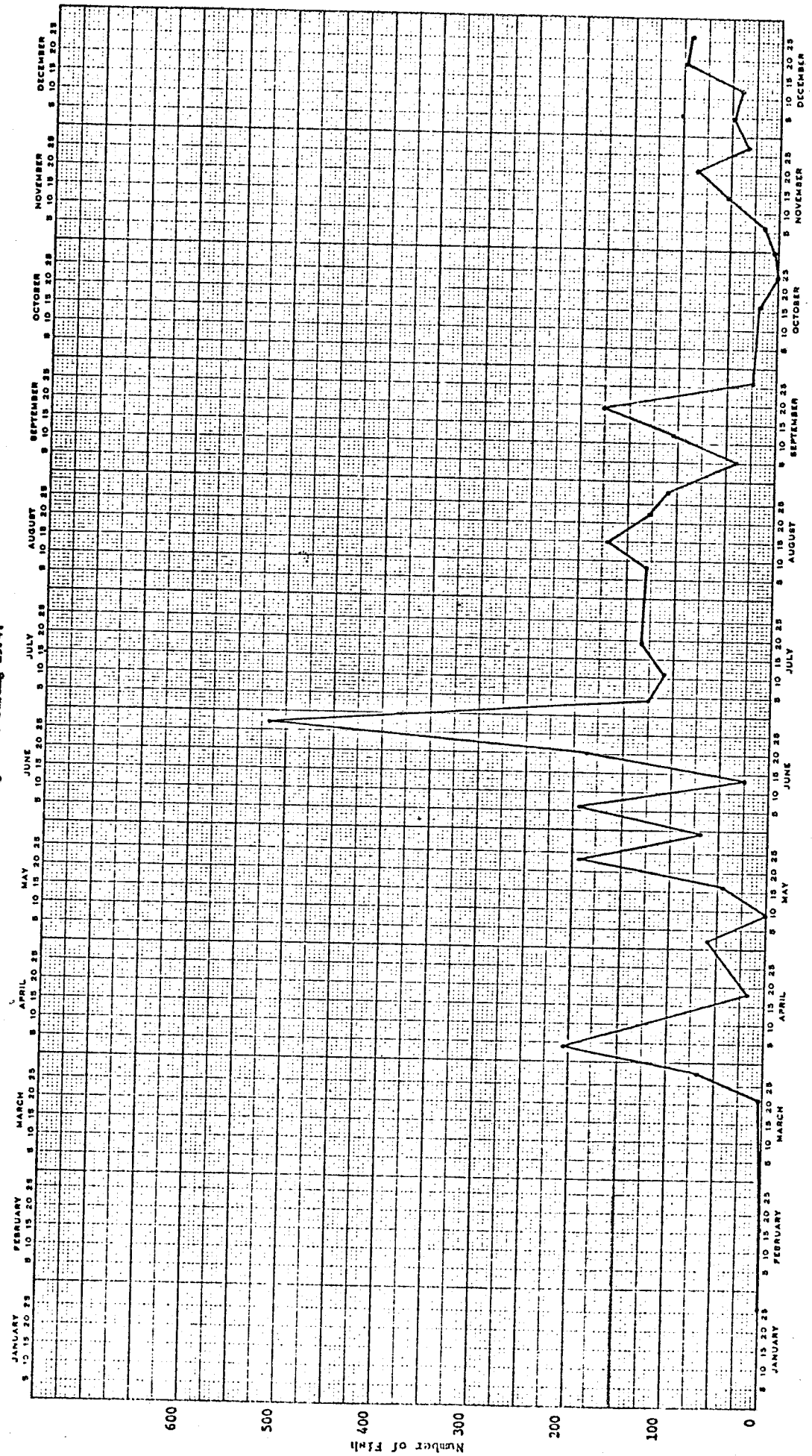


FIGURE 8

Fish Less than Six Inches Impinged on Cooling Water Intake Screens at Gorgas Steam Electric Generating Plant - January - July 1975

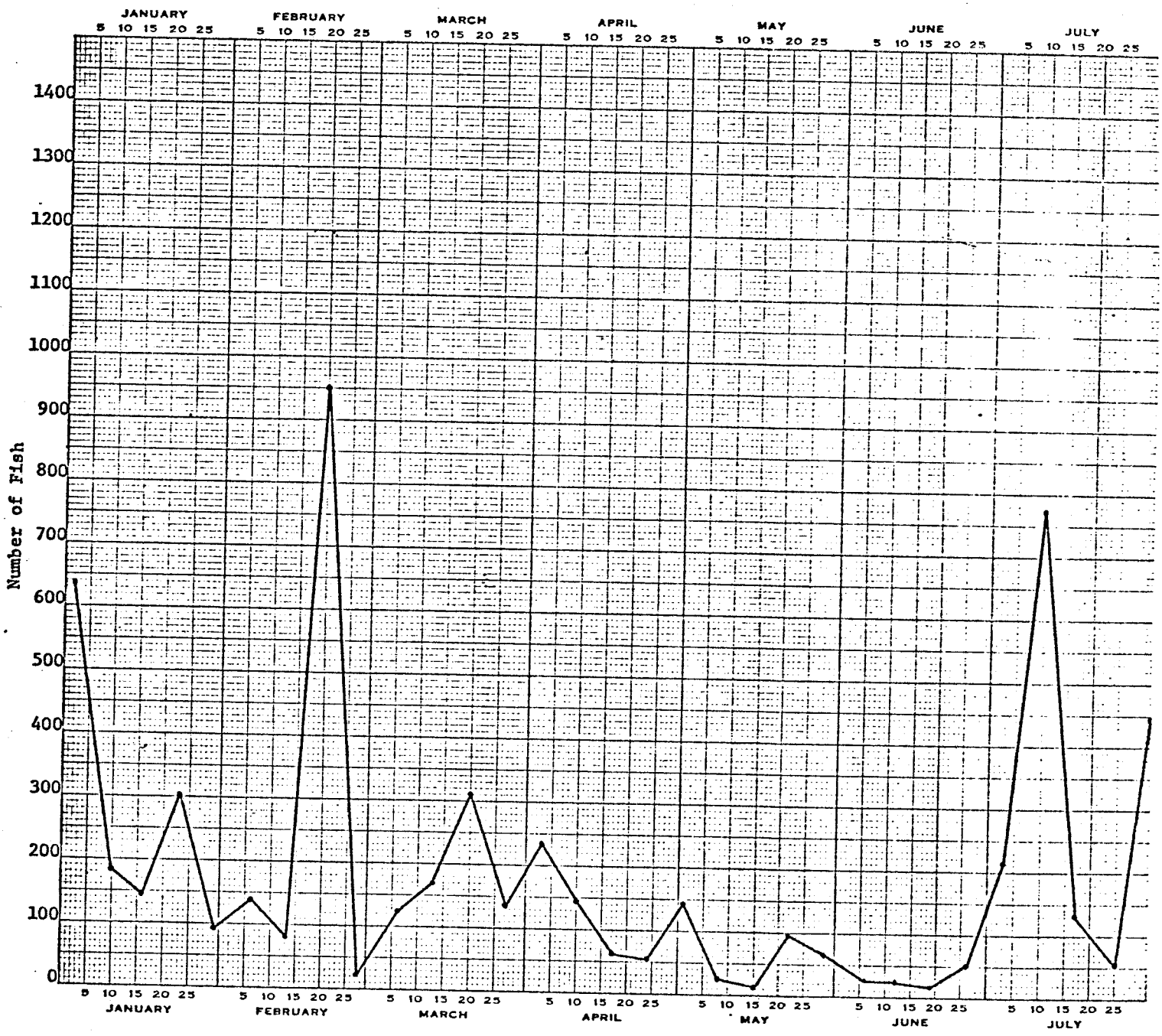
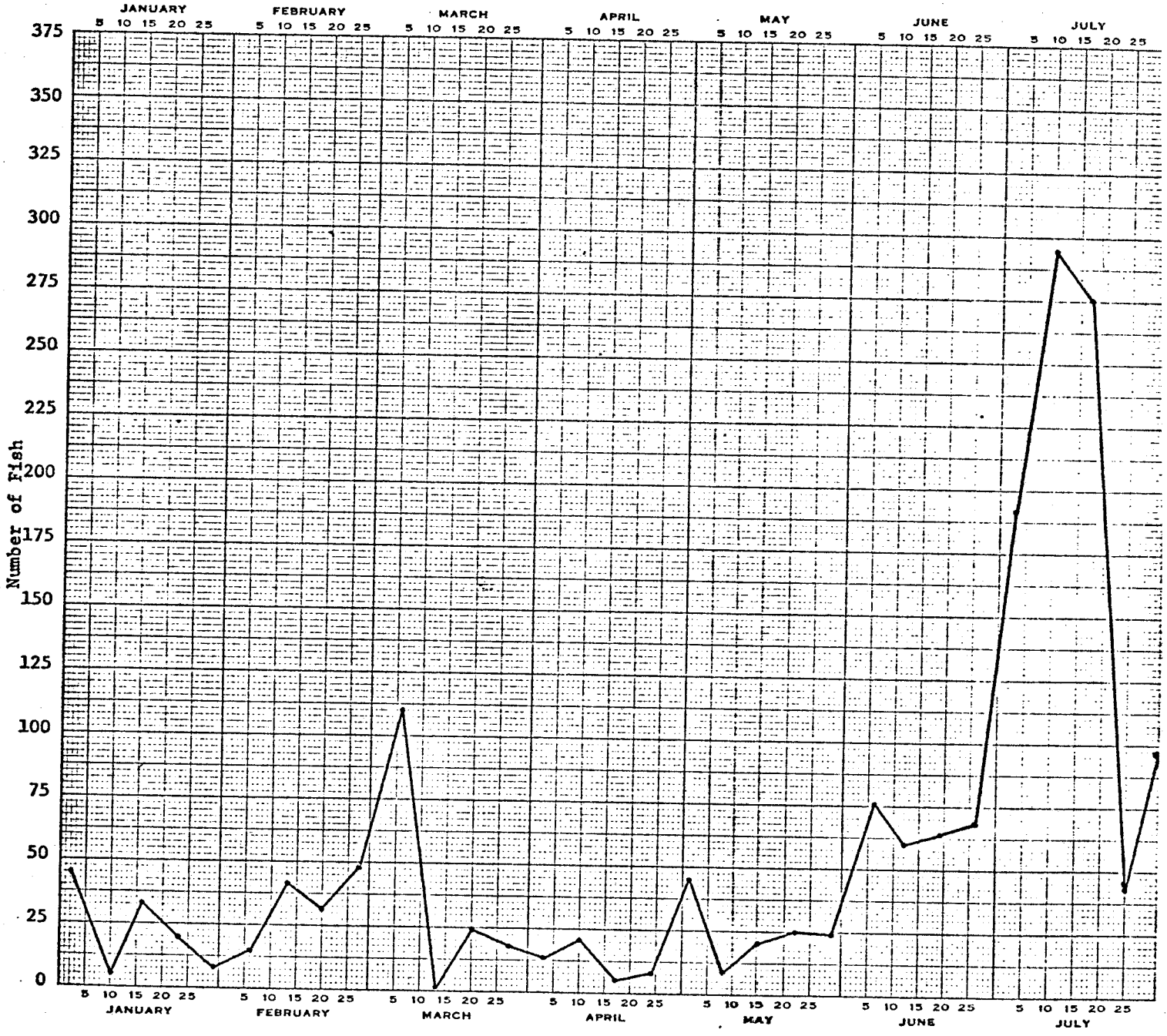


FIGURE 9

Fish Greater than Six Inches Impinged on Cooling Water Intake Screens at Gorgas Steam Electric Generating Plant - Jan.-July, 1975



collected during the study, and were estimated to be impinged at the rate of 200,437 annually. Non-shad fishes collected during the study, in descending order of abundance, were the sunfish, catfish, crappie, suckers, drum, white bass, carp, largemouth bass, and buffalo. These fishes were estimated to be impinged at the rate of 1,859 annually. The average daily impingement rates for shad and non-shad fishes were estimated to be 554.22 and 5.08, respectively.

Shad were collected from the intake screens during each of the months sampled; however, 89% of the non-shad fishes collected in 1974 occurred during the months of April through August.

Shad populations in the Mulberry Fork are not expected to be significantly affected by impingement losses caused by Gorgas STeam Plant. The reproductive potential of shad,as well as their abundance, reduces the probability of significant impingement effects on populations of this species. The number of sport, commercial, and rough fishes collected during the study indicates that the effect of impingement on populations of these species would be insignificant.

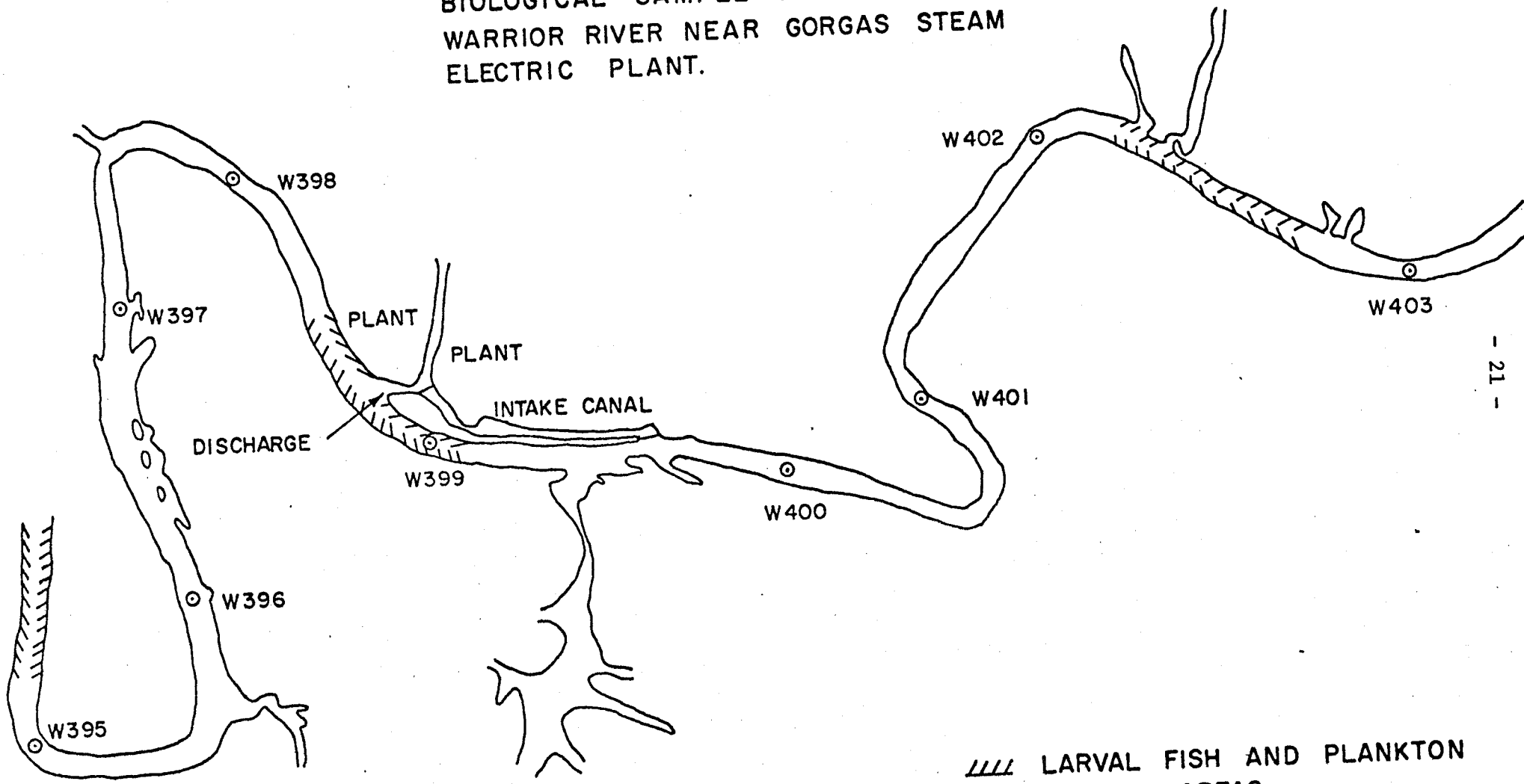
ENTRAINMENT

Plankton

Phytoplankton and zooplankton populations in the vicinity of Gorgas Steam Plant are being studied by Dr. John Lawrence, Department of Fisheries, Auburn University. Plankton samples are being taken quarterly from three sample areas (Figure 10) on the Mulberry Fork in the vicinity of Gorgas Steam Plant. The three sample areas include; (1) an upstream sample area above the Plant discharge, (2) a discharge sample area at the Plant, (3) a downstream sample area below the influence of the discharge. Plankton samples were taken at depths of 0, 1, 2, 4, and 8 meters. Phytoplankton samples consisted of a 500 milliliter water

FIGURE 10

BIOLOGICAL SAMPLE STATIONS ON THE WARRIOR RIVER NEAR GORGAS STEAM ELECTRIC PLANT.



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sample pumped from each of the sample depths. Zooplankton was sampled by pumping 40 liters of water from each sample depth through an 80 micron plankton net.

Icthyoplankton (larval fish) was sampled during the spring of 1974 and 1975. Samples were taken from three areas on the Mulberry Fork near the Plant (Figure 10), as well as the intake canal. Larval fish were sampled in the River by towing a plankton net, with an attached flowmeter, for approximately 15 minutes. The quantity of water filtered during each tow was approximately 100 cubic meters. Samples were taken at a depth of 5 feet during 1975. The intake canal was sampled by placing a stationary net at a depth of 5 feet for 30 minutes.

Phytoplankton

Phytoplankton data have been obtained for two sample periods. Samples were taken during October 1974 and May 1975. Data collected during the May sample period indicates a significant increase in total phytoplankters over the October sample period (Tables 6 and 7). The principal genera of algae collected during the October sample period were Oscillatoria, Gymnodinium, Scenedesmus, Ankistrodesmus, and Pandorina (Appendix II, Tables 1, 2, and 3.) Oscilatoria, Scenedesmus, and Ankistrodesmus were common in all sample areas. Quantitative determinations indicated lower concentrations of phytoplankton in both the discharge and downstream sample areas, as compared to the upstream sample area, during both sample periods. During the October sample period, the average number of phytoplankters per milliliter in the upstream sample area was greater than the discharge and downstream sample areas by 42% and 17%, respectively. In May the average number of phytoplankters per milliliter in the upstream sample area was greater than the discharge

TABLE 6

GORGAS PLANT AREA
Total Phyto and Zooplankton Organisms Collected at each Sampling Station and Depth at 1200 Hours on October 22, 1974

Station	WRM: 402	WRM 398.7	WRM: 395
Phytoplankters per ML			
Depth (meters)			
0	440	171	398
1	532	192	428
2	418	365	368
4	195	179	166
8	115	76	54
Zooplankters per L			
0	544	78	19
1	507	61	59
2	450	403	242
4	415	131	180
8	67	58	18

TABLE 7

GORGAS PLANT AREA
Total Phyto and Zooplankton Organisms Collected at each
Sampling Station and Depth
May 15, 1975

Phytoplankters per ml

Station	WRM: 402.5		WRM: 398.7		WRM: 395	
Depth (meters)	Time		Time		Time	
	1000	2200	1100	2300	1200	2400
0	1371	1454	480	351	789	568
1	1289	660	445	431	472	643
2	585	886	451	517	467	758
4	540	734	330	567	508	497
8	389	383	549	262	408	545

Zooplankton Total No. Organisms per L

0	128	1034	42	185	322	426
1	679	920	50	134	194	371
2	174	329	43	27	217	110
4	64	126	106	73	84	29
8	6	34	87	16	14	51

and downstream sample areas by 47% and 32%, respectively.

Zooplankton

Zooplankton populations were sampled during October 1974 and May 1975. Zooplankton population densities (Tables 6 and 7) in October and May were similar within sample areas. During the May sample period, the most abundant constituents of the zooplankton community were the rotifers. Dominant genera identified in the May samples were Keratella, Polyarthra, Bosmina, Cyclops, Diaptomus, and Kellicottia (Appendix II, Tables 1, 2, and 3).

The density of zooplankters in the three sample areas differed considerably during both sample periods. The number of zooplankters per milliliter in the upstream sample area was greater than the discharge sample area by 63% in October and 78% in May. Zooplankton densities in the upstream sample area were also greater than densities found in the downstream sample area. The zooplankton density in the downstream sample area was found to be less than the upstream sample area by 74% in October and 48% in May.

Icthyoplankton

Larval fish samples were collected from the Mulberry Fork near Gorgas Steam Plant during the spring of 1974 and 1975. A total of 683 larval fish were collected during seven sample periods in 1974 and five sample periods in 1975. Samples were taken from three locations in 1974 and five locations in 1975 (Figure 10). An additional sampling point downstream of the Plant was added during the 1975 monitoring period. The average number of larval fish per cubic meter of sample for each sample area and period is presented in Table 8. The number of larvae collected and the quantity of water sampled during each

TABLE 8

Average Number of Fish Larvae Per Cubic Meter of Water at each Sample Location on the Warrior River near Gorgas Steam-Electric Generating Plant*
1974 - 1975

Date	Upstream	Discharge	Downstream	Intake Canal
4/15/74	0	0.07	-	0
4/26/74	0.02	0.02	-	0
5/6/74	0.11	0.01	-	0.03
5/20/74	0.25	0.01	-	0
5/29/74	0.02	0.06	-	0
6/5/74	0.14	0.17	-	0.06
7/11/74	0	0	-	0
3/27/75	0	0	0	0
4/15/75	0	0.01	0	0
5/5/75	0.03	0.50	0.16	0
5/14/75	0.06	0.14	0.42	0
5/29/75	0.10	0.12	0.13	-

* Data in this table is a summary of detailed data presented on larval fish samples.

collection period may be found in the Appendix II, Tables 6 and 7.

Larval fish appeared earlier in the discharge sample area, as compared to the sample areas, during both the spring of 1974 and 1975 (Table 8.) The number of larvae per cubic meter in each sample area varied considerably between sample periods. The density of larval fish in the discharge sample area was greater than either the upstream or downstream sample areas during 10 of the 12 sample periods. Larval fish were collected in the intake canal during only three of the twelve sample periods. Peak larval fish concentrations measured in 1974 for the upstream sample area, discharge sample area, and the intake canal were 0.25, 0.17, and 0.06 larvae per cubic meter, respectively. Larval fish concentrations during the 1975 monitoring period had peak values in the upstream, discharge, and downstream sample areas of 0.10, 0.50, and 0.42 larvae per cubic meter, respectively. Two larval fish were collected in the intake canal during one sample period in 1975; however, due to malfunction of the flowmeter, data was not available for quantifying the sample. Based on previous flow data, this sample was estimated to contain 0.06 larvae per cubic meter.

Plankton Community

The skimmer wall at Gorgas Steam Plant results in the withdrawal of cooling water from the lower 25% of the When the River is not stratified, plankton populations are more evenly distributed throughout the water column than periods when stratification exists. When the River is stratified, the majority of the plankters are found in the upper surface waters. Therefore, based on the depth at which cooling water is withdrawn, the quantity of plankton entrained through the Plant varies seasonally with River stratification. Even during

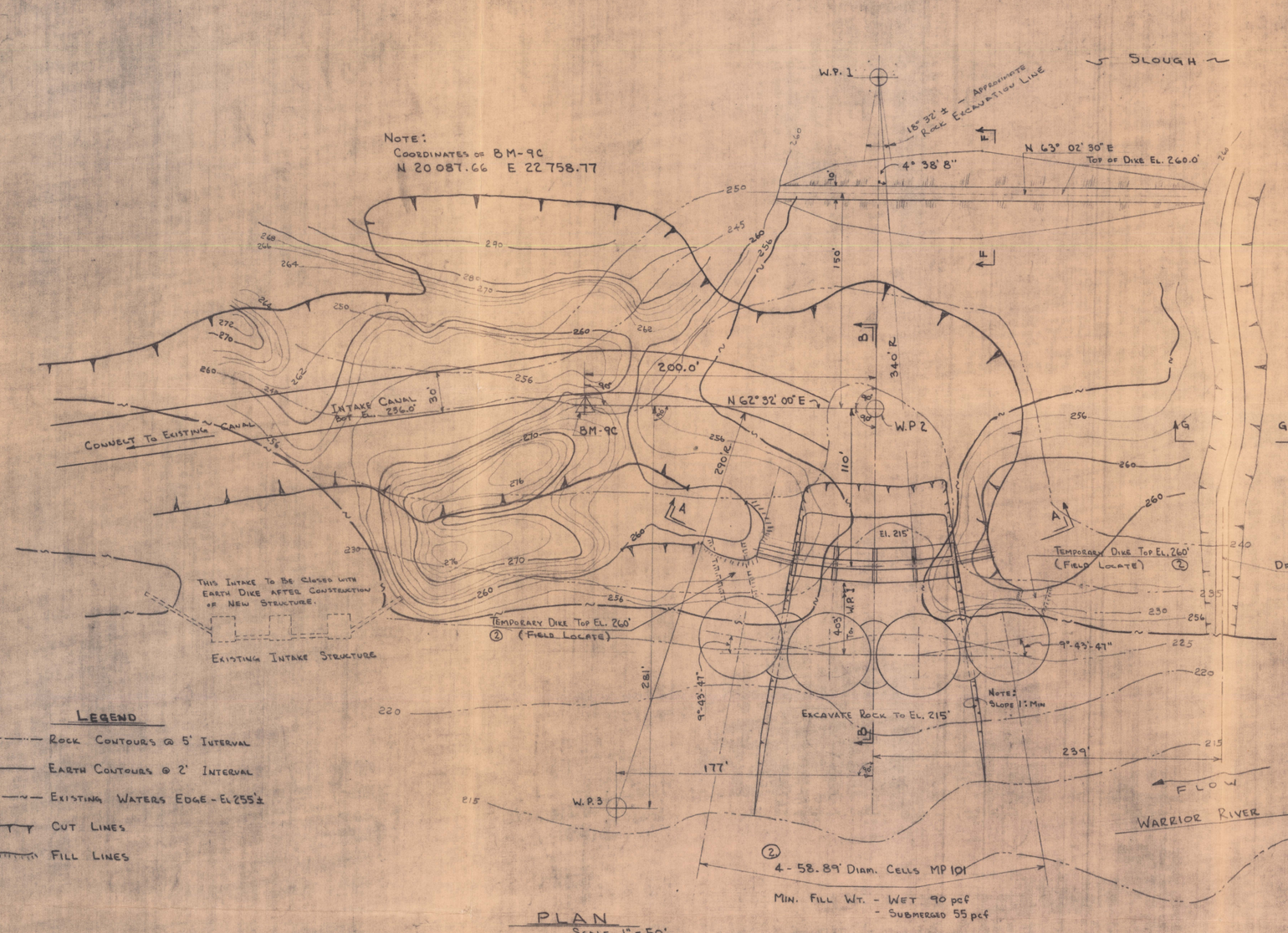
periods when the River is not stratified, the deep water intake results in relatively little withdrawal from the plankton productive, or photic zone, characteristic of upper surface water.

Zooplankton and phytoplankton population densities upstream of the Plant were greater than the discharge and downstream sample areas during both sample periods. The effects of Gorgas Steam Plant on plankton densities is primarily due to the skimmer wall intake system. The skimmer wall, at the intake, results in the withdrawal and subsequent discharge of water with low plankton densities. The reduction in surface plankton densities near the discharge area is not considered to have a significant effect on plankton populations downstream. Population densities in the downstream sample area (approximately 3.7 miles below the Plant) were greater than in the discharge area during both sample periods, which indicates the effects of the Plant on surface plankton populations are limited to a relatively small portion of the River.

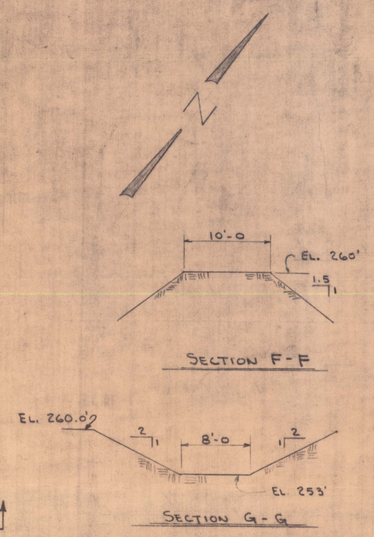
Larval fish densities in the vicinity of the Plant were comparable to densities found in both upstream and downstream control areas. Samples collected in the intake canal did not contain larval fish during 75% of the sample periods. Larval fish densities in the intake canal were considered low during those periods for which larvae were collected. The entrainment of larval fish in the upper surface waters of the Mulberry Fork is limited due to the deep water intake of the Plant. It is concluded that larval fish populations in the vicinity of the Plant are not significantly affected by entrainment.

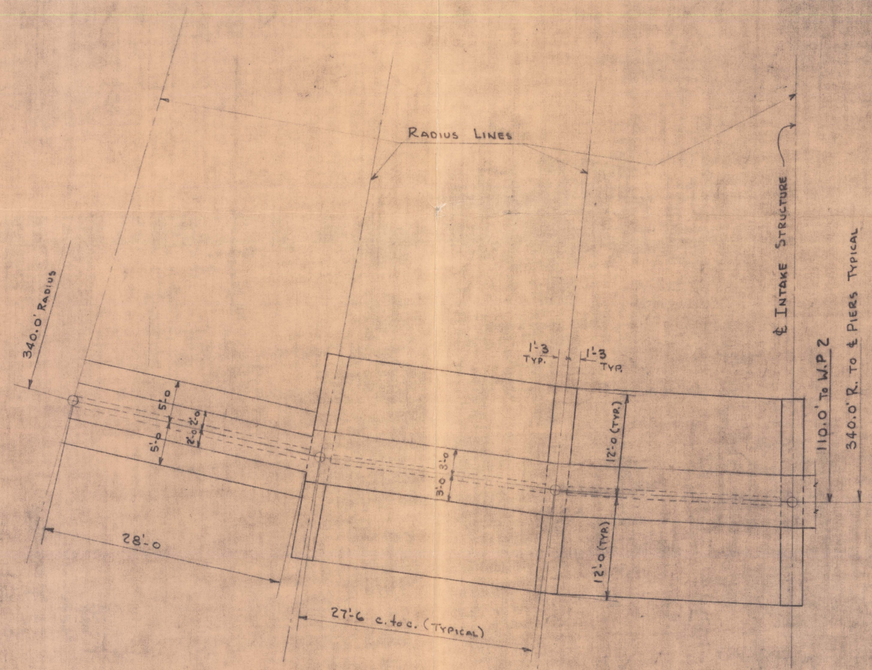
Appendix 1

SECTION 1

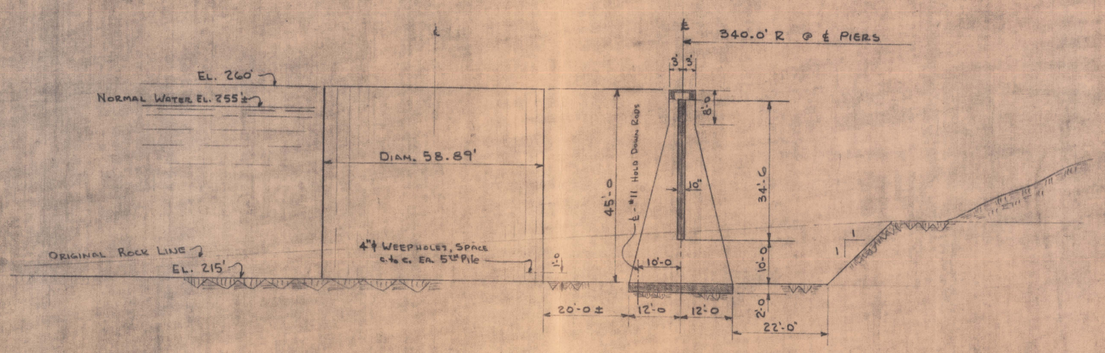


PLAN
Scale 1" = 50'

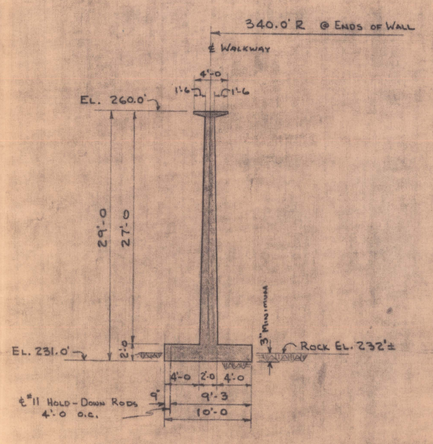




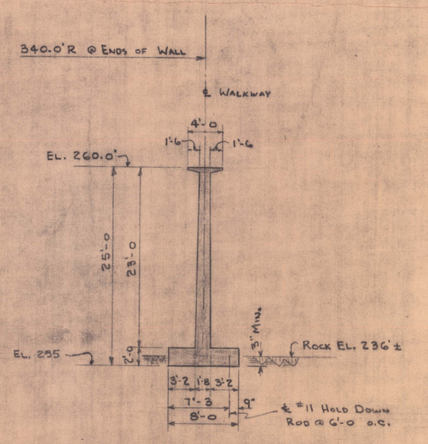
Intake Structure Half Plan
Similar @ ℄
Scale 1" = 10'-0



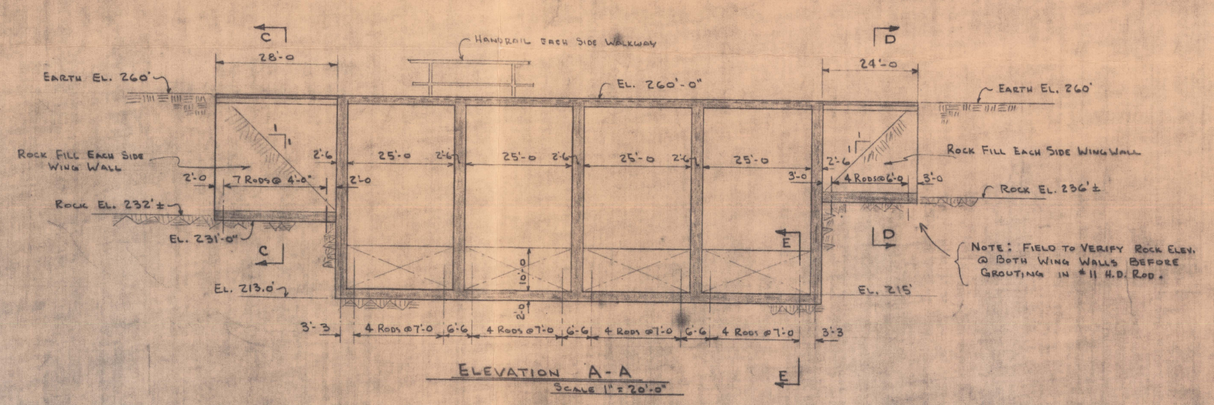
Section B-B Thru ℄ Intake
Scale 1" = 20'



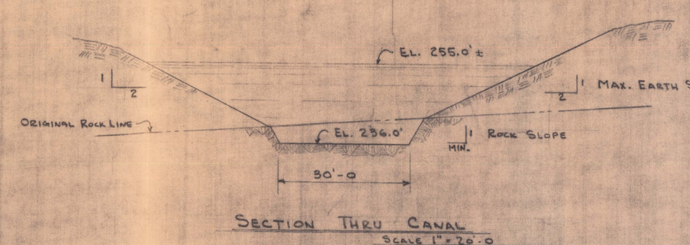
Section C-C
Scale 1" = 10'



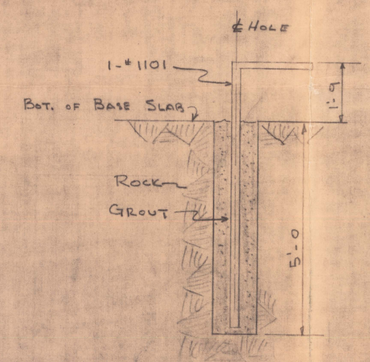
Section D-D
Scale 1" = 10'



Elevation A-A
Scale 1" = 20'-0"



Section Thru Canal
Scale 1" = 20'-0



Section E-E - Typical Hold Down Rod
No Scale

Notes:
Piles Shall Be Driven To Rock.

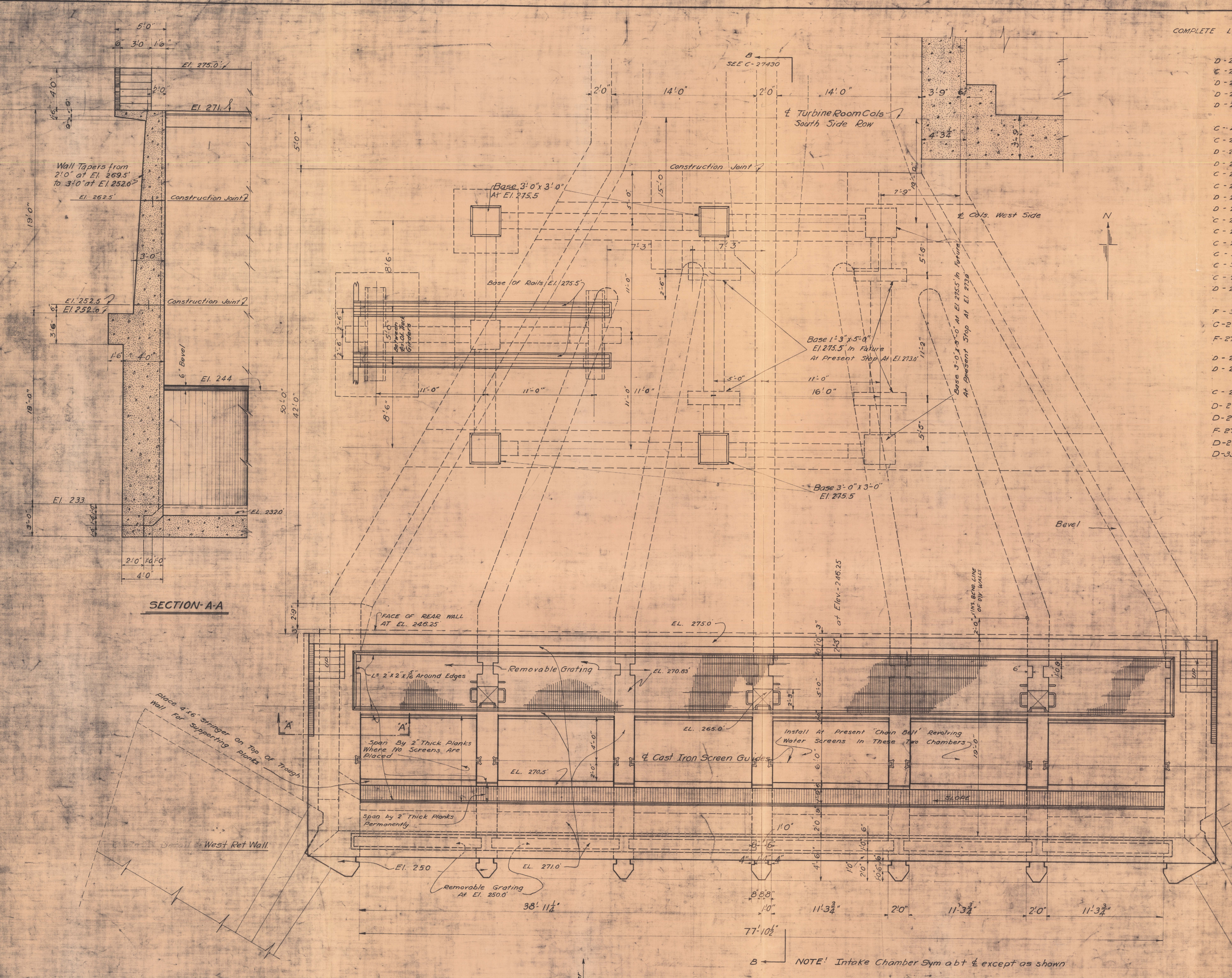
References:

E-88754	APCO Location Drawg For Intake Study
D-88701	River Intake Structure Concrete N.L.
D-88702	do do do Concrete Reinf.
BR-88700	Bill of Reinforcing.

Rev. #2 5/9/57 REC. Changed Size, Number, & Location of Cofferdam Cells & Added Temporary Earth Dikes.	Rev. #1 4/2/57 REC. Removed Gravel Filter From Bottom of Cells.	DRAWN REC CHECKED HW TRACED	SOUTHERN SERVICES, INC. FOR ALABAMA POWER COMPANY
		APPROVED [illegible] DATE 3-15-57	JOB Gorgas Steam Plants
		APPROVED [illegible] DATE 3.15.57	DETAIL River Intake Structure Layout
			SCALE As Noted B/M
			SHEET OF SHEETS SUPERSEDES
			D-88700

Appendix 1

SECTION 2



PLAN AT ELEVATION 275

NOTES:
In Two Intake Chambers Where "Chain Belt" Screens Are Installed, Cast Iron Screen Guides Are Furnished By Same Company. In The Remaining Four Chambers Guides Are Furnished By Southeastern Engineering Company.

NOTE:
Hand Railings And Lamp Posts Are Not Shown In This Plan.

COMPLETE LIST OF DRAWINGS OF COOLING WATER INTAKE STRUCTURE

D-27429	Neat Lines Of Intake Chamber - Plan (This Sheet)
C-27430	Neat Lines Of Intake Chamber - Transverse Section
D-27435	Neat Lines Of Floor Mat.
D-27415	Reinforcing Steel For Floor Mat.
D-27424	Center Division Wall For Tunnel And All Division Walls For Intake Chamber
C-27425	Inside Division Walls For Tunnel.
C-27423	Outside Division Walls For Tunnel.
D-27417	Outside Walls Of Tunnel
D-27427	Neat Lines And Steel For Deck Slab Of Tunnel
C-27420	North Wall Of Intake Chamber
C-27421	South Wall Of Intake Chamber
D-27418	East And West Walls Of Intake Chamber
D-27422	Screen Trough And Grate Carrying Girders.
C-27419	Hand Railings And Lamp Posts
C-27416	Bar Bending Diagrams
C-27426	Bills Of Material For Parts Of Structure
C-33098	Front Elevation Of Intake Chamber.
C-33587	East Side Elevation Of Intake Chamber And Tunnel
C-27431	Trash Rack
D-27428	General Arrangement Of Intake Chamber, Foreboy And Wing Walls
F-33091	Cast Iron Screen Guides
C-27432	Neat Lines Of Wing Walls
F-27434	Cast Iron Marker Plates
D-27433	Excavation Diagram - Plan
D-287-1	General Arrangement Of Chain Belt Co. "Rex" Traveling Water Screen {Foreign Print
C-27656	Plan Of Lighting Arrangement At El. 271 And El. 275
D-27436	Reinforcing Steel In Footing Of Wing Walls
D-27438	Reinforcing Steel In Walls & Buttresses Of Wing Walls
F-27437	Curb Angles At El. 271.0'
D-27439	Skeleton Structure On Roof Of Intake Tunnel
D-33649	Piers For Skeleton Structure

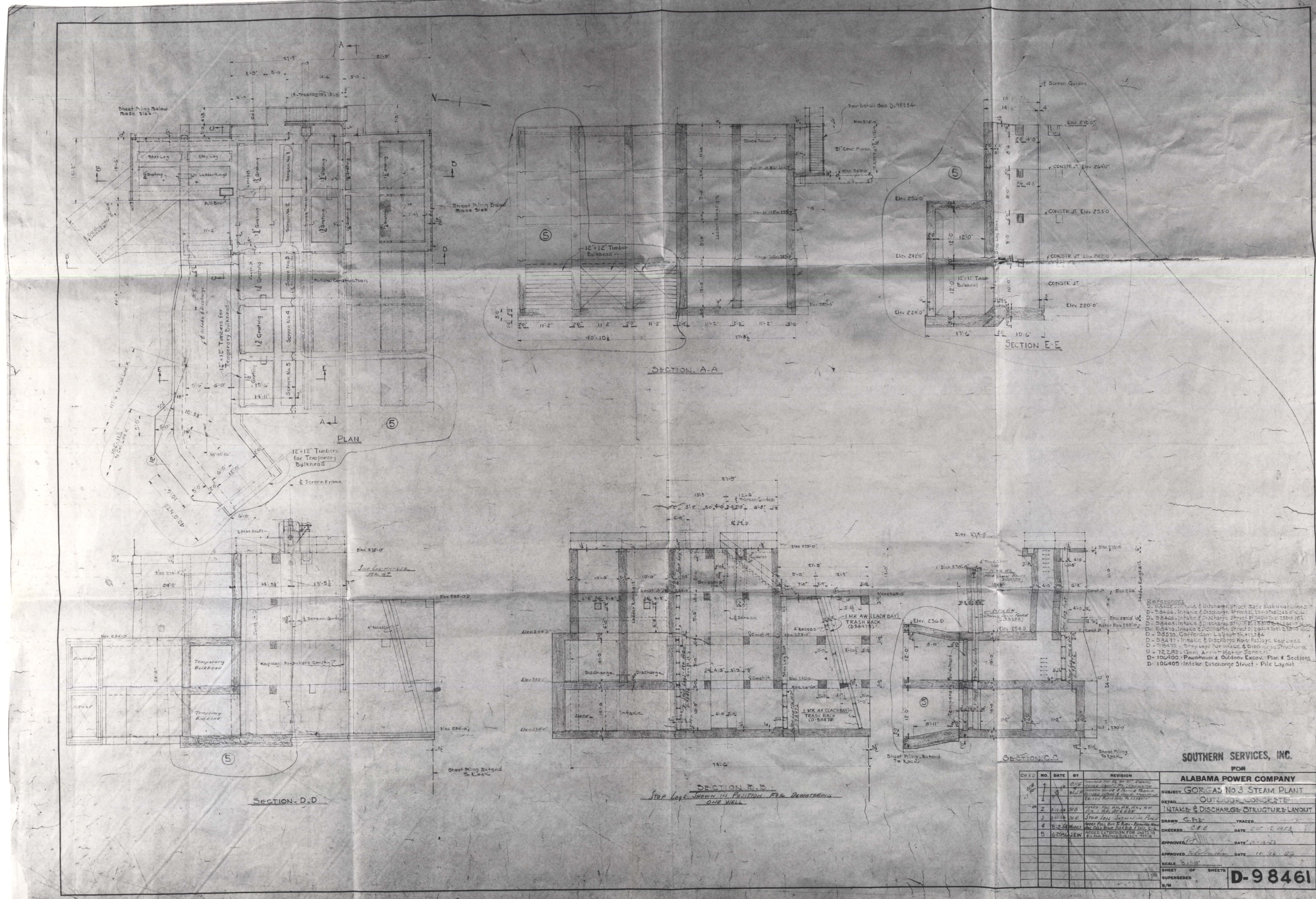
NO.	DATE	BY	I.R. NO.	REVISION

SOUTHEASTERN ENGINEERING COMPANY
FOR ALABAMA POWER COMPANY
SUBJECT GORGAS STEAM PLANT [redacted] #2
DETAIL COOLING WATER INTAKE CHAMBER NEAT LINE - PLAN
DRAWN R. Smith TR. H. Habel 4-6-28 CH. C.T. 8-4-28
APPROVED John M. Gillespie DATE 8-4-28
DESIGNING ENGINEER
APPROVED DATE
ELECTRICAL ENGINEER
APPROVED DATE
CHIEF ENGINEER
SCALE ORIGINAL I.R. NO.
SHEET NO. OF SHEETS
SUPERSEDES

D-27429

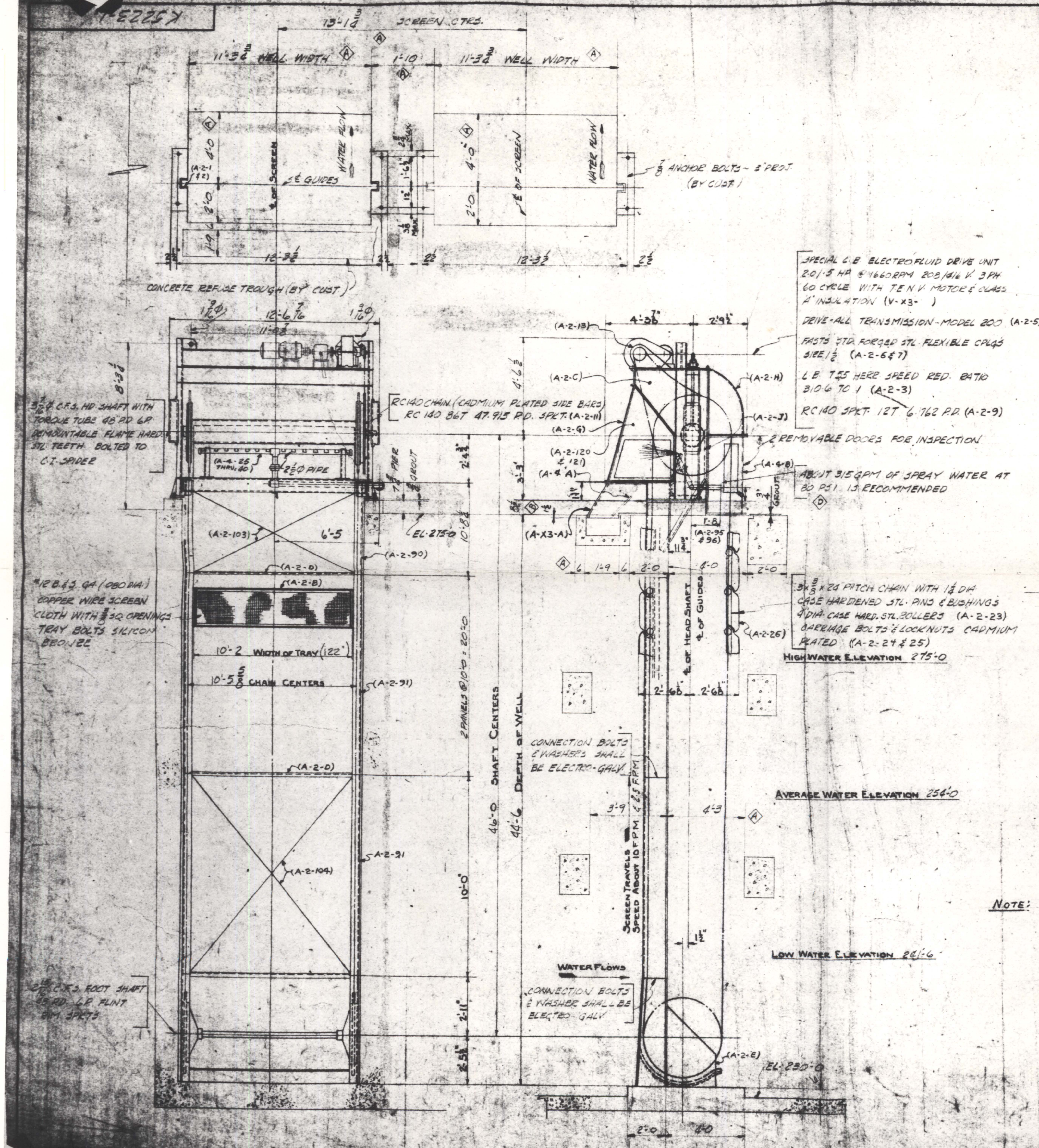
Appendix 1

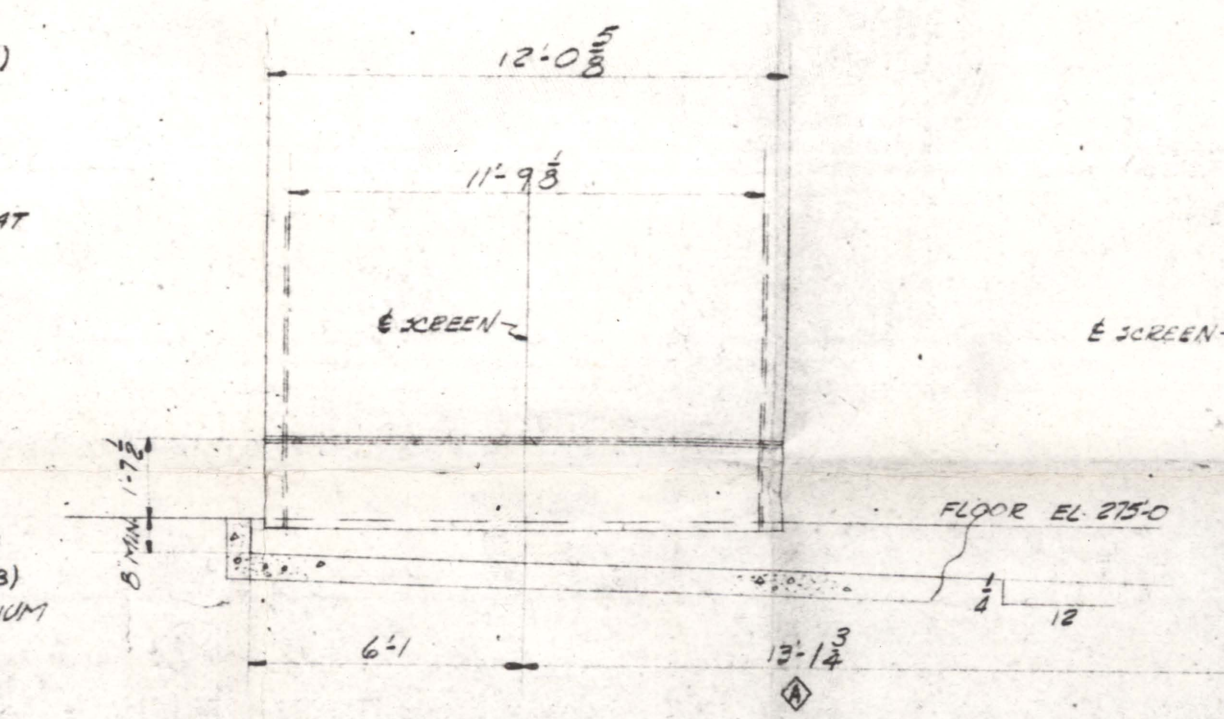
SECTION 3


PLAN
SECTION A-A
SECTION E-E
SECTION D-D
SECTION B-B
Stop Logs Shown in Position for Dewatering One Well
SECTION C-C
12"x12" Timbers for Temporary Bulkhead
Future Construction
Sheet Piling Below Base Slab
Sheet Piling Extend To Rock
Temporary Bulkhead
1 Mk AW (Each Bay) Trash Rack (D-58479)
Intake
Discharge
References
D-98462 - Intake & Discharge Struct. Base Slab Neat Lines
D-98464 - Intake & Discharge Struct. El. 230'-0 To El. 242'-0" N.L.
D-98466 - Intake & Discharge Struct. El. 242'-0 To El. 253'-0" N.L.
D-98468 - Intake & Discharge Struct. El. 253'-0 To El. 264'-0 N.L.
D-98470 - Intake & Discharge Struct. El. 264'-0 To El. 275'-0 N.L.
D-98370 - Cofferdam Layout Sh. #1, 2, 3 & 4
D-98477 - Intake & Discharge Water Passage Neat Lines
D-98472 - Stop Logs For Intake & Discharge Structure
U-72283 - Genl. Arrgt. Water Screen
D-106400 - Powerhouse & Outdoor Excav. - Plan & Sections
D-106405 - Intake - Discharge Struct - Pile Layout
SOUTHERN SERVICES, INC.
FOR
ALABAMA POWER COMPANY
SUBJECT GORGAS No 3 STEAM PLANT
DETAIL OUTDOOR CONCRETE
INTAKE & DISCHARGE STRUCTURE LAYOUT
DRAWN C.F.E.
TRACED
CHECKED C.E.B.
DATE OCT 12, 1953
APPROVED
DATE 10-14-53
APPROVED
DATE 10-16-53
SCALE 1/8" = 1'-0"
SHEET OF SHEETS
SUPERSEDES
B/M
D-98461
CH'K'D
NO.
DATE
BY
REVISION
1
C.F.E. & W.J.P.
Changed Inv. El. on 21" Drain; Added Const. Jts.; Relocated Screen Guide & Sluice Trench; Revised Intake & Disch. Manifold; Raised Pump Hole to El. 260'-0"
2
3-12-54
CEB
Added Mks HH, AR, AX, AW, AO, AP, AT & REF
3
3-26-54
CEB
Stop Logs Shown in Place
4
8-3-54
Myers
Added Pull Box to Plan - Removed Hand Rail - Chg'd Beam Elev. D-D & Sect. C-C
5
6-20-56
JEW
Added Extension for Units 10 & 11 and Revised Subject Title

Appendix 1

SECTION 4





FRONT ELEVATION OF CONCRETE REFUSE TROUGH

CONTRACT DRAWING AND EQUIPMENT SUMMARY

UNIT QUAN.	UNIT NAME	DIVISON OF CONTRACT LETTER	DIVISON OF CONTRACT EQUIPMENT	CONTRACT DRAWINGS NUMBER	CONTRACT DRAWINGS EQUIPMENT SHOWN	MAT'L LIST ON DWG
2	WATER			K5223-1	GEN'L. ARRANGEMENT	
	SCREEN	A	COMPLETE	K5223A-2	MAT'L LIST OF MACHY, FRAME	A-2
			SCREEN LESS		TRAYS & HSGS.	
			ELECT. EQUIP	K5223A-X3	TRASH, CHUTE	A-X3
				K5223A-4	MAT'L LIST OF TRASH	A-4
					LIP, HSG. & SPRAY PIPE	
				K5223-5	WIRING DIAGRAM	
		V	ELECT. EQUIP.	K5223V-X6	MAT'L LIST. ELECT. EQUIP.	V-X6
				K5223V-X7	MAT'L LIST ELECT. EQUIP.	V-X7

LINK-BELT COMPANY
CHICAGO
DATE JUL 16 1954
ISSUED TO
THIS PRINT VALID ONLY FOR PURPOSE INDICATED BELOW
MAINTAINED
REFERENCE
LIMITED TO ORDER NO.
SHOP
PURCH.
EST. NO.
FIRST ISSUE
REPLACEMENT
DUPLICATE
REVISION ADDED
GROUP ADDED
PIECE ADDED

NOTE:

CAPACITY 112,000 G.P.M. PER SCREEN @ NORMAL WATER LEVEL IN PIT OF 23'-6 @ VELOCITY 1.84 FPS THRU 100% CLEAN SCREEN.
THE MAIN FRAME & BOOT SECT. SHALL BE GALVANIZED & ALL OTHER SCREEN PARTS EXCEPT SCREEN CLOTH SHALL BE GIVEN ONE COAT BITUMASTIC ~ ALL MAIN FRAME & BOOT SECT. BOLTS SHALL BE ELECTRO-GALVANIZED

2 SCREENS FINISHED COMPLETE WITH 2 1/2 SETS OF GUIDES
WT. OF SCREEN W/OUT GUIDES = 31,430# (APPROX.)
WT. OF SCREEN W/OUT CHAIN & TRAYS = 13,430# (APPROX.)
WT. OF COMPLETE HD SECTION = 7,500# (APPROX.)
(THE HD SECTION WEIGHTS MORE THAN ANY OTHER SCREEN SECTION)

REFER TO INSTRUCTION MANUAL 342Y III, CZ1927, CO74790, & CO74965 FOR ALL FIELD ASSEMBLY & PARTS LIST

REV.	DATE	DESCRIPTION
D	7-15-54	VALVE REMOVED TO BE FURN. BY CUST.
C	3-10-54	EQUIP. SUMMARY & MAT'L [illegible]
B	3-8-54	1 1/4" DIM. ON TRASH CHUTE [illegible]
A	3-2-54	GEN'L REVISION

GENERAL ARRANGEMENT OF MODEL 45 WATER INTAKE SCREEN
ALABAMA POWER COMPANY
BIRMINGHAM, ALABAMA
G. LARSON
2-17-54
LINK-BELT COMPANY
K5223-1

Appendix 2

TABLE 1

Gorgas Steam Plant
Plankton Sampling
Oct. 22, 1974 - 1130 - 1230 hours

Station	Upstream area, R. M. 402.5				
Depth, m.	0	1	2	4	8
Phytoplankton		Number per liter			
Pennate diatoms	43,800	22,000	51,257	42,285	42,743
Centric diatoms	0	4,400	0	0	0
Coccoid greens	135,571	233,201	169,543	74,000	54,400
Filamentous greens	6,258	4,400	23,657	2,115	1,943
Colonial blue-greens	16,686	35,200	15,772	12,685	3,886
Filamentous blue-greens	54,229	30,800	55,200	38,057	9,714
Dinoflagellates	183,542	202,401	102,515	25,372	1,943
TOTAL	440,086	532,402	417,944	194,514	114,629
Dominant organisms	Oscillatoria angustissima in all samples				
	Gymnodinium limneticum	G. limneticum	Ankistrodesmus falcatus	A. falcatus	S. quadricauda
	Scenedesmus quadricauda	S. quadricauda	G. limneticum	G. limneticum	
Zooplankton					
Rotifers	505.0	480.9	440.1	345.0	48.6
Copepod nauplii	35.0	23.6	5.6	59.2	0
Copepod adults	0.9	1.7	2.0	5.2	1.7
Cladocerans	2.6	0.8	2.0	5.2	17.0
TOTAL	543.5	507.0	449.7	414.6	67.3
Dominant organisms	Keratella cochlearis in all samples				
	Polyarthra	Polyarthra	Polyarthra	Polyarthra	Bosmina longirostris
	Copepod nauplii	Copepod nauplii	Copepod nauplii	Copepod nauplii	Cyclops sp.
		Copepodid stage	Copepodid stage	Copepodid stage	Diaptomus sp.

TABLE 2

Gorgas Steam Plant
Plankton Sampling
Oct. 22, 1974 - 1300 - 1400 hours

Station	Outfall area , R. M. 398.7				
Depth, m.	0	1	2	4	8
Phytoplankton		Number per liter			
Pennate diatoms	29,857	40,628	35,200	20,858	15,214
Centric diatoms	0	0	0	0	0
Coccoid greens	59,715	74,486	180,400	85,514	31,443
Filamentous greens	8,143	11,286	8,800	4,171	3,043
Colonial blue-greens	5,42	6,772	8,800	12,514	11,157
Filamentous blue-greens	32,572	47,400	96,800	35,458	10,143
Dinoflagellates	29,857	9,028	30, 00	18,771	4,057
Euglena	5,428	2,258	4,400	2,086	1,014
TOTAL	171,000	191,858	365,200	179,372	76,071
Dominant organisms	Ankistrodesmus falcatus Oscillatoria angustissima Scenedesmus acuminatus Pandorina charkowiensis		A. falcatus O. angustissima S. acuminatus S. quadricauda	A. falcatus O. angustissima	
Zooplankton					
Rotifers	63.4	50.0	358.0	40.9	9.9
Copepod nauplii	10.3	6.4	31.4	48.3	3.3
Copepod adults	3.6	2.8	8.8	22.1	3.5
Cladocerans	0.6	1.3	4.4	19.5	41.4
TOTAL	77.9	60.5	402.6	130.8	58.1
Dominant organisms	Keratella cochlearis Polyarthra Copepodid stage Copepod nauplii	K. cochlearis Polyarthra Copepodid stage Copepod nauplii	K. cochlearis Bosmina longirostris Cyclops sp. Diaptomus sp. Copepod nauplii	K. cochlearis Kellicottia Polyarthra Cyclops sp. Copepod nauplii	B. longirostris Diaptomus sp.

TABLE 3

Gorgas Steam Plant
Plankton Sampling
Oct. 22, 1974 - 1030 - 1130 hours

Station	Downstream area, R. M. 395				
Depth, m.	0	1	2	4	8
Phytoplankton		Number per liter			
Pennate diatoms	12,000	25,200	29,829	12,171	12,762
Centric diatoms	0	0	0	0	0
Coccoid greens	93,600	187,200	159,087	42,600	16,591
Filamentous greens	0	7,200	4,971	2,029	1,276
Colonial blue-greens	9,600	21,600	19,387	10,143	815
Filamentous blue-greens	47,999	75,600	69,600	56,000	14,038
Dinoflagellates	33,600	108,000	84,514	34,486	5,105
Euglena	2,401	3,600	0	8,114	3,828
TOTAL	398,400	428,400	367,888	165,543	54,415
Dominant organisms	Scenedesmus quadricauda and Oscillatoria angustissima in all samples				
	Ankistrodesmus falcatus Pandorina charkowiensis	A. falcatus P. charkowiensis Gymnodinium limneticum	A. falcatus G. limneticum	Pandorina charkowiensis	A. falcatus
Zooplankton					
Rotifers	14.3	44.6	198.1	155.4	2.2
Copepod nauplii	4.3	10.7	33.7	5.4	0
Copepod adults		1.9	5.9	16.9	12.8
Cladocerans		1.3	4.4	1.9	3.0
TOTAL	18.6	58.5	242.1	179.6	18.0
Dominant organisms	Keratella cochlearis Bosmina longirostris Copepod nauplii	K. cochlearis Kellicottia Polyarthra Copepodid stage Copepod nauplii	Kellicottia K. cochlearis Copepod nauplii	Kellicottia B. longirostris Copepod nauplii Copepodid stage	Cyclopoid copepod

TABLE 4

Field notes on Warrior River in vicinity of Gorgas Steam Plant, October 22, 1974

Clear sky, wind less than 6 mph.

Air temperature 72° F

Upper site - mi. 402.5
0 m - 76.3° F
1 m - 76° F
2 m - 76° F
4 m - 73° F
8 m - 72° F

Outfall
0 m - 85° F
1 m - 83° F
2 m - 80° F
4 m - 77° F
8 m - 73° F

Downstream
0 m - 78° F
1 m - 78° F
2 m - 78° F
4 m
8 m - 72° F

Secchi disc - 42 inches

Light loss to 4 meters - 87.5%

TABLE 5

Temperature and Oxygen Data Collected During Plankton
Sample Period on the Warrior River Near Gorgas
Steam-Electric Generating Plant
May 14-15, 1975

Location	Date	Time	Depth	Temperature (°C)	Oxygen (PPM)
Upstream[1]	5/14/75	2100-2400	0'	25	10.5
Upstream	5/14/75	2100-2400	10'	20	7.4
Upstream	5/14/75	2100-2400	20'	17.5	6.0
Discharge[2]	5/14/75	2100-2400	0'	25	8.0
Discharge	5/14/75	2100-2400	10'	25	8.2
Discharge	5/14/75	2100-2400	20'	19	6.0
Downstream[3]	5/14/75	2100-2400	0'	23	9.0
Downstream	5/14/74	2100-2400	10'	22	7.8
Downstream	5/14/75	2100-2400	20'	19.5	6.2
Upstream	5/15/75	0900-1200	0'	24	8.8
Upstream	5/15/75	0900-1200	10'	23	6.8
Upstream	5/15/75	0900-1200	20'	18	5.5
Discharge	5/15/75	0900-1200	0'	26.5	7.6
Discharge	5/15/75	0900-1200	10'	24.5	7.7
Discharge	5/15/75	0900-1200	20'	19	5.5
Downstream	5/15/75	0900-1200	0'	23	8.7
Downstream	5/15/75	0900-1200	10'	21	6.9
Downstream	5/15/75	0900-1200	20'	20	6.9

1. Upstream.....WRM 402.5
2. Discharge....WRM 398.7
3. Downstream...WRM 395

TABLE 6

LARVAL FISH PER CUBIC METER OF WATER IN THE WARRIOR RIVER NEAR GORGAS STEAM ELECTRIC PLANT

Location	Date	Number of Larval Fish	Cubic Meters Filtered	Larval Per Cubic Meter
Upstream[1]	4-15-74	0	104.165	0
Intake Canal[2]	4-15-74	0	35.210	0
Discharge[3]	4-15-74	7	106.267	0.066
Upstream	4-26-74	2	115.277	0.017
Intake Canal	4-26-74	0	43.301	0
Discharge	4-26-74	3	128.474	0.023
Upstream	5-6-74	13	116.761	0.111
Intake Canal	5-6-74	1	32.737	0.030
Discharge	5-6-74	1	112.344	0.009
Upstream	5-20-74	30	118.457	0.253
Intake Canal	5-20-74	0	89.183	0
Discharge	5-20-74	7	113.987	0.061
Upstream	5-29-74	2	112.750	0.018
Intake Canal	5-29-74	0	82.152	0
Discharge	5-29-74	6	107.133	0.056
Upstream	6-5-74	13	94.836	0.137
Intake Canal	6-5-74	6	107.733	0.056
Discharge	6-5-74	18	109.041	
Upstream	7-11-74	0	113.881	0
Intake Canal	7-11-74	0	107.733	0
Discharge	7-11-74	0	108.634	0

1. Upstream - WRM 400.5 - 401.0
2. Intake Canal - In canal parallel with WRM 399.2
3. Discharge - WRM 398.25 - 398.75

TABLE 7.

Larval Fish Per Cubic Meter
of Water in the Warrior River
Near Gorgas Steam-Electric Generating Plant
1975

Date	Location	Depth	No. of Fish	Cubic Meters Filtered	No/m^3
3/27/75	Upstream	5'	0	103.15	-
3/27/75	Upstream	10'	0	111.21	-
3/27/75	Discharge[2]	5'	0	96.76	-
3/27/75	Discharge	10'	0	116.09	-
3/27/75	Downstream[3]	5'	0	107.51	-
3/27/75	Downstream	10'	0	103.34	-
3/27/75	Intake Canal[4]	5'	0	31.70	-
4/15/75	Upstream	5'	0	102.56	-
4/15/75	Upstream	10'	0	116.16	-
4/15/75	Upstream	15'	0	118.01	-
4/15/75	Discharge	5'	0	117.64	-
4/15/75	Discharge	10'	1	119.24	0.01*
4/15/75	Discharge	15'	1	104.73	0.01
4/15/75	Downstream	5'	0	124.52	-
4/15/75	Downstream	10'	0	106.95	-
4/15/75	Downstream	15'	0	110.75	-
4/15/74	Intake Canal	5'	0	28.56	-

Date	Location	Depth	No. of Fish	Cubic Meters Filtered	No/m^3
5/5/75	Upstream	5'	6	116.23	0.05
5/5/75	Upstream	10'	2	96.32	0.02*
5/5/75	Upstream	15'	2	97.68	0.02
5/5/75	Discharge	5'	48	111.21	0.43*
5/5/75	Discharge	10'	1	96.94	0.10*
5/5/75	Discharge	15'	113	117.02	0.97*
5/5/75	Downstream	5'	0	98.67	-
5/5/75	Downstream	10'	0	93.73	-
5/5/75	Downstream	15'	53	114.09	0.47
5/5/75	Intake Canal	5'	0	47.11	-
5/14/75	Upstream	5'	6	97.13	0.06*
5/14/75	Upstream	10'	9	109.67	0.08
5/14/75	Upstream	15'	3	97.00	0.03
5/14/75	Discharge	5'	10	106.30	0.09*
5/14/75	Discharge	10'	34	137.47	0.25*
5/14/75	Discharge	15'	7	106.33	0.07
5/14/75	Downstream	5'	3	89.59	0.03*
5/14/75	Downstream	10'	104	134.07	0.78*
5/14/75	Downstream	15'	53	116.16	0.46*
5/14/75	Intake Canal	5'	0	-	-

Date	Location	Depth	No. of Fish	Cubic Meters Filtered	No/m^3
5/29/75	Upstream	5'	12	90.61	0.13
5/29/75	Upstream	10'	12	93.05	0.13
5/29/75	Upstream	15'	4	81.87	0.05
5/30/75	Discharge	5	2	93.91	0.02*
5/30/75	Discharge	10'	10	97.16	0.11
5/30/75	Discharge	15'	28	127.23	0.22*
5/30/75	Downstream	5'	15	112.14	0.13
5/30/75	Downstream	10'	17	110.44	0.15*
5/30/75	Downstream	15'	16	105.03	0.12
5/29/75	Intake Canal	5'	2	-	-

1. Upstream Control Area ..... WRM 402.5-403.0
2. Discharge Area..... WRM 398.5-399.0
3. Downstream Control Area..... WRM 394.0-394.5
4. Intake Canal ..... In canal parallel with WRM 399.2

*Eggs Present

TABLE 8

Temperature and Dissolved Oxygen Data
for Larval Fish Sample Periods
on the Warrior River near
Gorgas Steam Electric Generating Plant
1975

Sample Date	Sample Location	Temperature/Dissolved Oxygen 0.0 ft.	5 ft.	10 ft.	15 ft.
3/27/75	Upstream[1]	12.0/-	12.0/9.6	12.0/9.6	-
	Discharge[2]	22.0/-	18.5/8.7	16.5/9.5	-
	Downstream[3]	13.5/-	13.5/9.20	13.5/9.5	-
	Intake[4]	12.2/-	12.0/9.30	-	-
4/15/75	Upstream[1]	12.9/-	12.9/9.45	12.9/9.45	13.0/9.40
	Discharge[2]	17.3/-	15.0/9.45	13.7/9.4	13.5/9.30
	Downstream[3]	13.9/-	13.9/9.5	13.9/9.5	13.9/9.5
	Intake[4]	13.8/-	13.8/9.7	-	-
5/5/75	Upstream[1]	25.1/-	25.1/7.8	25.0/7.7	22.5/8.0
	Discharge[2]	26.2/-	26.0/7.0	24.5/6.95	23.2/6.85
	Downstream[3]	24.0	23.9/7.2	23.5/7.0	21.0/6.55
	Intake[4]	19.2/-	-	-	-
5/14/75	Upstream[1]	23.9/-	-	-	-
	Discharge[2]	27.8/-	-	-	-
	Downstream[3]	26.7/-	-	-	-
	Intake[4]	-	-	-	-
5/29/75	Upstream[1]	25.0/-	-	-	-
	Discharge[2]	28.3/-	-	-	-
	Downstream[3]	26.4/	-	-	-

1. Upstream Sample Area: WRM 402.5-403.0
2. Discharge Sample Area: WRM 398.5-399.0
3. Downstream Sample Area: WRM 394.0-394.5
4. Intake Canal: WRM 399.2